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Agricultural Research Service

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DEPOSIT

AGRICULTURAL ECONOMICS RESEARCH

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Writing as a Tool for Economic Research

By Esther M. Colvin and Ronald L. Mighell

This article calls attention to the usefulness of an often neglected but basic tool of the economist's trade—the art of writing so as to carry ideas as exactly as possible from one mind to another, and sometimes from one part of one mind to another part of the same mind. Writing is a tool both in doing research and in presenting research results.

DEPOSIT

ONE OF THE TOOLS of economic research that is not always recognized is good writing. Like other tools, writing may be put to different uses. It may be used for truthful communication or for skillful concealment of real meanings. Even the Indians distinguished between those who spoke with the straight or the forked tongue.

This paper is concerned with the use of language on the part of those seeking true knowledge. John Locke (*8*)[1] thought that a word if properly used should "excite in the hearer the same idea which it stands for in the speaker." John Locke was a part of the revolutionary 17th century in England. The ideas expressed in his famous *Essay Concerning Human Understanding* grew out of an inquiry into what the human mind could know and not know. The *Essay* was really a treatise on the meanings of words as tools of investigation and action. Locke's suggestions were to make ideas as clear and distinct as possible by the use of words "as near as may be to such ideas as common usage has annexed them to."

Until they have been organized and put into readable form by the research worker, the results he has obtained from his research study are of value only to himself. Good writing, and by *good* writing, we mean *effective* writing, in any field is a powerful tool. Witness Thomas Paine's pamphlet, "The American Crisis" (*12*), which gave the cold and starving men at Valley Forge new impetus to help them through that dreadful winter when hope was at its lowest ebb. "These are the times that try men's souls!"

By effective writing we do not mean necessarily writing that has the personal touch—this is hard to attain in any kind of scientific writing—but writing that sets forth the subject clearly so that its readers can follow it with a minimum of difficulty.

Take the book written by an entomologist in the Department of Agriculture a few years ago (*6*). This scientist, who used his book as an example of how not to write, in a writing workshop held in Laramie, Wyo., a year or so ago, had a subject that should have been of tremendous interest to many persons. A part of the book was about a fly that causes myiasis, a skin disease, in human beings, as well as in animals. Little had been known of its habits before that time. He had made an exhaustive study of the insect. He was an authority on the subject. But to date his book has sold less than 1,000 copies.

Why was this? Because, as he has come to realize, he wrote the book for himself, not for his readers. He used scientific terms without bothering to explain them in words that a layman could understand. He chose the many-syllabled words rather than the short, direct words. He neglected

[1] Numbers in italics in parentheses refer to Literature Cited, page 128.

to break up his paragraphs. His sentences were long and involved. So today, the book gathers dust on library shelves.

Economists Need To Write Effectively

If effective writing is important to physical scientists, it is doubly so to economists and other social scientists. But we are concerned here only with economics. Economics is less exact than the physical sciences. Economists must often reason from inadequate data; must depend to a considerable extent on logic.

The very nature of economics places an ethical obligation on economists to use the resources of communication more efficiently than others. Economics has to do with the maximum utilization of resources. The findings of agricultural economists are intended to be applied, to be used by farmers and those who work either directly or indirectly with farmers. How and to what extent they will be applied depends upon how effectively they are presented. If the results of a project or a study made by an economist or by several economists working together are not presented clearly and effectively, the value of the study is largely lost.

In Marshall's definition (*10*), "economics is a study of mankind in the ordinary business of life." To a large degree, each man is his own economist. No esoteric wall, therefore, separates economists from the criticisms of "practical" men. Whatever an economist writes must be clear or he is likely to be misunderstood or not even listened to.

Fred W. Decker, writing in Science (*1*), says, "Scientists can make a real contribution to the general public understanding of science by adopting more specific and understandable language. The language used should be understandable at least to the elements of society concerned with making decisions on the basis of such reports. . . ."

Mr. Decker is speaking of physical scientists, but his remarks apply equally to economists.

Economists and other social scientists are more dependent on effective writing than physical scientists. Geneticists may have new crops or new breeds of livestock to show for their labors. Agricultural engineers may invent new farm machines or improved types of farm buildings. It is only infrequently that research economists have tangible evidence other than written reports to show for their services.

What the house is to the builder, the painting to the artist, the model machine to the engineer, the written report is to the research economist. The younger research economist needs to write effectively in order to advance professionally. His writing is the yardstick by which his progress is measured, the index used by his colleagues in appraising his professional status. The older established economist must continue to write effectively if he is to retain his standing in his field.

An economist who has written little over a period of time is thought of as one who does not finish things. The one who turns out many mediocre reports and articles is considered energetic but careless, not a first-rate workman. A moderate but sustained output of high-quality writing will "win the most friends and influence the most people."

Why Writing Is a Research Tool

Why is writing a research tool? A little thought will bring the answer to this question. Writing of some kind begins with the first project statement and continues until the report that grows out of the project is published. Writing is a part of all phases of the research study. Project statements, annual reports, statements of progress, correspondence, and research notes, as well as the final manuscript for publication, constitute writing. Each of these kinds of writing serves a different purpose and is directed to a particular person or persons. The analytical process is influenced by each.

Good writing, then, is writing that communicates most effectively. This definition assumes something to communicate. It also assumes that some action, or lack of action, will be induced in the reader.

What Makes Good Writing?

What are the attributes of good writing? There is *style*, which is highly individual. Sir Arthur Quiller-Couch (*13*) says, "Essentially style resembles good manners. . . ." In many respects, style is a matter of personal preference. But successful communication means that attention must be paid also to the personal preferences of the readers, or rather, the potential readers.

For instance, there are expressions and forms of speech that are likely to antagonize readers. A

manuscript that is larded with such phrases as "In other words," "On the other hand," "It is interesting to note," makes editors, at least, see red. Let's take the statement, "It is interesting to note." It may be interesting to an author to note a certain fact, it's true, but how can he be certain that his readers will find it so? He would do better to let them be the judge. The phrase "In general" is much favored by economists. It has about as much meaning as the phrase, once popular but seldom heard or seen now, "in the final analysis." "On the other hand" is seldom needed. As for the phrase "In other words," if the matter has been explained once in clear, direct language, why use other and probably not as effective words to repeat the explanation? If it is additional explanation, the phrase is incorrect.

Phrases such as these are calculated to remove the "sparkle" from any manuscript. You may think that sparkle is to be found only in fiction or poetry—in "literary" writing. This is not the case. Sparkle is found in all kinds of writing. Without it, readers will begin to yawn before they have finished a page; they will toss the offending communication aside, and any "message" it may have contained will be nullified.

Let us look at the following brief passages from three different economists (*3*, *17*, *2*). Do they arouse your interest in the subject each has to treat? Notice the variation in style.

"This association of poverty with progress is the great enigma of our times. It is the central fact from which spring industrial, social, and political difficulties that perplex the world, and with which statesmanship and philanthropy and education grapple in vain. From it come the clouds that overhang the future of the most progressive and self-reliant nations. It is the riddle which the Sphinx of Fate puts to our civilization, and which not to answer is to be destroyed."

. . . . . .

"Is our marketing machinery too complicated? . . . This may seem complicated and mysterious. It is complicated, but it need not be mysterious. A watch is a complicated mechanism, but there is no great mystery about it. Few would object because a modern watch is more complicated than an hourglass or than a sundial—at least not if the watch runs well. Nor should we object to a complicated system of marketing if the parts are well coordinated."

. . . . . .

"It is told that such are the aerodynamics and wing-loading of the bumblebee that, in principle, it cannot fly. It does, and the knowledge that it defies the august authority of Isaac Newton and Orville Wright must keep the bee in constant fear of a crackup * * *.

". . . The present organization and management of this American economy are also in defiance of the rules—rules that derive their ultimate authority from men of such Newtonian stature as Bentham, Ricardo, and Adam Smith. Nevertheless it works and in the years since World War II quite brilliantly. . . ."

. . . . . .

Sparkle in writing means variety in vocabulary, phraseology, figures of speech, paragraphing, length of sentence, and in anything else that goes into writing. Variety in vocabulary doesn't mean using all the words of 3, 4, or more syllables the writer knows or can find in the dictionary.

The shortest, simplest words that will express the meaning intended are best. This doesn't mean that the longer words cannot be used. Often, they must be used. But they should be sprinkled throughout the manuscript, not shaken over it as with a salt shaker.

Writers would do well to remember that use of the third person passive can be abused. The direct statement is better—We did so and so rather than so and so was done. (But beware of *we* when only one writer is expressing himself. This is the prerogative of royalty and editors.) Use of the active voice also helps to weed out excess verbiage.

The precise word is better than the abstract word. Such general words as condition, situation, and position are usually excess. Instead of saying weather conditions, why not say weather? The meaning is the same.

Some writers apparently believe that participles are to be treated like charms on a bracelet. But this is not the case. Participles were never intended to dangle. For instance, "Having come of age, I took my son into partnership with me."

A participle, like an adjective, leans on the nearest noun for support and the following sentence suggests that the economist had just arisen from a meal of index numbers. "Arising from a misinterpretation of the index series, the economist appeared untroubled by the criticism."

Economists are inclined to endow ordinary words and phrases with special meanings. For instance, the word *income* as used by economists may refer to tangible goods as well as to cash income. The word *universe* used to delineate the area of an economic study is likely to startle laymen when they see it used in this way for the first

time. *Global* for *total* is more familiar in England than in the United States.

It is usually well to use the old tried and true words to express meanings. Economists are likely to look for the extraordinary words. It sometimes seems to editors that they spend a good deal of time searching the fine print at the bottom of the page in dictionaries to obtain the little-used word, the variant. Of course, they are not the only ones who do this. It is true also of physical scientists, other social scientists, and members of the legal profession. Members of any specialized profession tend to develop their own terminology.

Macroeconomics and *microeconomics* are terms that reflect a useful distinction. They are nice words to show that you have kept up with the times. But the small difference of one letter may lead to embarrassing errors in communication. As with stalactites and stalagmites, some readers are confused as to which is up and which is down.

The adjective *stochastic* implies the presence of a random variable; for example, *stochastic variation* is variation in which at least one of the elements is a random variable. The word was known in the 16th century but passed out of usage until recently revived. If a word of this kind must be used, it should be accompanied by an explanation until it is well known and can be found in a dictionary.

Economists are sometimes guilty of stating self-evident facts. More than once, truisms found in economic reports have led to facetiousness on the part of legislators and newspaper reporters.

Paragraphs that extend over a page or even half a page and sentences that run for 5 or 6 lines are also calculated to take the sparkle out of any manuscript. The piling up of nouns as modifiers, a practice that is popular with today's writers, sometimes reaches a point at which it is impossible to find the subject of the sentence. A look at newspaper headlines will verify this statement. The writer of headlines, however, has some excuse. He is allowed only so much space and must condense his headline until it fits that space. The writer of an article is not bound in this way.

When he begins a sentence with "Manufacturers order backlogs for durable goods," it takes the reader awhile to discover that manufacturers are not ordering logs but merely have unfilled orders on hand.

Brevity is usually all to the good, although it can be overdone. We have all heard the speaker who took an hour to say what he could easily have said—what he did say—in the first 15 minutes of his talk. The reader's reaction to an overdone report is much the same as the listener's reaction to a speaker of this kind. But the telegraphic style of writing that is in vogue in certain quarters does not lend itself to economic writing.

Writers on economics sometimes find it desirable to emphasize certain statements by repeating them. But a writer should be chary of repetition. It can be carried to excess. All editors have met manuscripts in which the writer makes a statement at the beginning of the paragraph. Three sentences down, the same thought appears. The words are twisted around, it's true. But the meaning is the same. These "sleepers" are often hard to detect. This is why so many editors have gray hair.

One difficulty that confronts the writer of economic reports is the seeming necessity of "hedging." Often, an economist does not feel that he can come right out and say that if so and so happens, the result will be thus and so. Instead, he says: "It is likely." "Probably." "It may." "It could." But hedging can be carried to excess and it offends some readers to the extent that they become vocal about it.

Frequently, rewording will avoid hedging. Take the sentence in a Demand and Price Situation report:

"Apparently businessmen are generally optimistic about their future sales prospects." This has been diluted to the point of uncertainty. Perhaps it means: "Businessmen are optimistic about sales prospects." One cannot be sure.

Sir Ernest Gowers (*5*) says, "It is wise not to begin to write until you are quite certain what you want to say. . . ."

This should not be interpreted as advice to put off writing to a later time. Of course, you will not begin to write until you have your ideas clarified. But the longer the task is put off, the harder it becomes. Certainly, none of you will be like the student in a writing course, who had come almost to the end of the semester without submitting so much as one sheet of manuscript. When the professor said, "Miss Blanc, it now lacks only 3 weeks until the end of the semester. At the beginning of the course, I asked each student to submit so many

thousand words, either in one long manuscript, or divided into several shorter pieces. Just what are your intentions with regard to meeting the requirements of this course?"

Miss Blanc thought a moment, then replied, "Well, I thought I *might* write a novel."

Let us suppose that you, an economist, have analyzed your material, know what you want to say, and are ready to begin your final report. The thing to do first is to decide on your audience. Are you writing the report for professional agricultural workers? For farmers? Or for whom? This decision will affect all phases of your writing. If the report is intended for professional workers, you can include theory, formulas, involved tables, footnotes, and so on. But if you expect farmers to read your report, it must be written simply with a minimum of theory, methods, and statistics included.

Let us suppose that you are writing a more or less technical report. A good way to begin is to make an outline, listing all your main heads and your subheads. The outline may be subject to change as you go along, but you will find it a big help.

The *organization* of your finished report will take some thought. Here is a suggested plan of organization. First, a preface or foreword that will contain acknowledgments; the contents; a brief readable summary (this is always written last); a few pages of introduction setting forth the problem and its background, and telling why and how the study upon which the report is based was made and for whom it is intended; the main points brought out in the study, followed by minor points, all with suitable headings. Your long technical descriptions of procedures and any tables that contain background statistics belong in an appendix.

Standards

Publishers usually set up certain standards for their writers to follow. These are the *conventions of uniformity* that facilitate reading and communication. True, many of them are arbitrary; they have no more real basis than has the right-hand rule of the road that we in the United States follow. But think how much confusion on the highways is avoided because of it. Certain other countries follow the left-hand rule. It is equally effective. The point is that it is uniform throughout the country, not just in certain cities or localities.

In the same way, uniform rules for writing prevent many mental collisions. Each magazine, each publisher, each organization, whether private or governmental, has its own preferences and its own rules. These preferences and rules cover a number of items.

(1) *Spelling.*—Economists are not expected to use Esperanto in their writing. However, there are certain accepted spellings that may vary, depending upon who is to issue the report or paper. For instance, in the Department of Agriculture, we use *aline*, instead of *align; percent* instead of *per cent; equaled* instead of *equalled; sirup* instead of *syrup*. We join sweet and potatoes to make sweetpotatoes. If your research manuscript is to be issued by a State experiment station or a professional journal, the practice in regard to these and other words may be just the opposite. Each issuing agency usually has something in the way of a manual to guide authors in this respect. In the Department of Agriculture, we use the United States Government Printing Office Style Manual first, and Webster's Unabridged next. That is, if we do not find the preferred spelling or compounding of a word in the manual, we use the first preference in the dictionary.

(2) *Statistical tables.*—Suppose each person who prepares tables for Agricultural Statistics, issued by the United States Department of Agriculture, or for the Statistical Abstract of the Department of Commerce, were to follow entirely his or her own ideas in setting them up. There would be no uniformity as to table titles, boxheads, stubs, or the way in which the figures are presented. Users of the tables would be likely to become confused. In one table, they might find totals in one place; in the next, the totals would be somewhere else. The title and boxheads of one might be clearly worded to reveal the data contained in the table, but readers might have trouble finding out what the next table is all about. Standards do help (*16*).

(3) *Footnotes.*—Footnotes, which have been described as "little dogs barking at the text," should be as brief and as few as possible. Writers often use material in footnotes that should be in text, and vice versa. Bibliographical footnotes should contain all pertinent information: Author's name, title, publisher and place, number of pages, and

date of issuance. Many hours are spent by people in editorial offices in checking such references. For some reason, whether in the jotting down of information by authors or in typing, bibliographical citations are peculiarly liable to error. Not infrequently, the author's name is misspelled; only a part of the title is given; or the date of publication is many years off—in one instance recalled, the wrong century was given.

In Department of Agriculture series of publications, bibliographical references to the number of seven or more are pulled out of footnotes and made into a Literature Cited List, with items numbered and referred to by number in text. This avoids repetition and also reduces the number of footnotes. Although this method is not popular with authors—most of them are convinced that readers dislike turning back to the list and prefer to have the citation on the same page as the reference—it has worked very well in Department publications.

(4) *Punctuation.*—Proper punctuation is important to the meaning of your sentences, but less rather than more punctuation is the modern way. Practices vary with issuing agencies, but writers will find helpful a handbook such as the College Handbook of Composition (*19*). In the Department, the GPO Style Manual is supplemented by this and other handbooks.

(5) *Numerals.*—Whether to use figures in text or to write out numerals is a moot question. Some issuing agencies do one way; some another. As listed in the GPO Style Manual, the rules are somewhat complicated. Some State agencies write out any numeral under 10 and use figures for 10 or above. Probably the best method to follow for numerals is to rely on your editor to put them in line with accepted usage for you.

(6) *Use of numbers or letters to set off main points.*—Setting off your main points and subordinate points with numbers or letters or a system that includes both is good practice, although, like any other good thing, it can be carried to excess. Setting off the points in this way emphasizes them and makes it easier for the reader, especially if you have many points, with subpoints and sub-subpoints.

(7) *Word usage.*—Certain words function best when they are used in certain ways. The word "amount," for instance, is best when it refers to money; the word "quantity" when it refers to bushels, pounds, or some other measure.

Economists sometimes overwork certain words. One of these is the word "determine." Most economic manuscripts are peppered with it. It is said that only God can determine. Man can ascertain, calculate, estimate, learn, find out, or what have you. Make use of synonyms. A small investment in a pocket thesaurus will be of help here.

Amy Cowing, of the Federal Extension Service, advises authors to go on a "which" hunt. It makes for smoothness of writing to weed out *which* when *that* would do as well. Very often, neither is needed.

Superlatives should be used sparingly or not at all. This is true of all adjectives and adverbs. They weaken your manuscript. To some economic writers, all the points they make are important or "extremely" important. But the effect on the reader of all these importants and extremely importants is unfortunate. He soon tires of seeing the words and wonders whether anything in the report really is important. If you present your points and discuss them in clear direct language, you need not call attention to their importance. The reader will see that for himself.

Sir Ernest Gowers (*5*) speaks of adverbial "dressing-gowns," and cites *unduly*, *relatively*, and *comparatively* as those most favored by writers. Too often, these dressing-gown adverbs are used when there is no standard of comparison.

How To Improve Your Writing

No matter how good your style of writing, it can be improved. One way to do this is by reading good literature. The Atlantic, Harper's, and the Saturday Review are three of the magazines that come to mind in this connection. There are many books that might be read for this purpose. Different authors will appeal to different economists.

One of the most beautifully written pieces that we have seen is the editorial that the late William Allen White (*18*) wrote for the Emporia Gazette the day after the funeral of his daughter, a girl of 17 who was killed when the branch of a tree brushed her from her horse. This editorial has been reprinted many times. Most editorial pages are rewarding reading though one may disagree with the content. The quality of writing is usually high.

A second way to improve your style is to rewrite your manuscript. Many economists appear to have a compulsion against rewriting. They would rather tinker with and patch up a first draft than make a clean rewrite. As a result, many basically good articles and studies ultimately appear in a literary garb that is unworthy of their economic content.

It is said that Tolstoi rewrote "War and Peace" (*15*) seven times. Ellen Glasgow says in "The Woman Within" (*4*) that she always wrote three drafts of her books.

Your colleagues will review your manuscript from the viewpoint of subject matter. Your editor will try to help you present your subject matter in the most effective way. Both colleagues and editor may suggest rewriting of certain parts or all of your manuscript. Do not take these suggestions amiss. Welcome their comments. You, as the writer, are often too close to your work to see its drawbacks unless they are pointed out to you by a disinterested reviewer.

The opening paragraph of a manuscript may set the tone and pace for the whole report. See how this is done in the following two examples (*9, 7*):

"Nowhere is the contrast more striking than it is in England between the great industrial towns of the present time, humming with factories and black with smoke, and the quiet small towns of the past, where artisans and merchants went leisurely about their business."

. . . . . .

"Money is one of those concepts which, like a teaspoon or an umbrella, but unlike an earthquake or a buttercup, are definable primarily by the use or purpose which they serve. The use or purpose of money is twofold: it provides a medium of exchange and a measure of value."

In the first of these examples, one is given an immediate impression of the meaning of the industrial revolution by the picture of contrast. This is the subject of the whole book. The second example begins a difficult text on monetary theory by speaking simply of teaspoons, umbrellas, earthquakes, and buttercups, and at the same time giving a definition of money.

Caroline B. Sherman (*14*), the first editor of this magazine, who set high standards for the writing of reports in the former Bureau of Agricultural Economics, says:

"A slow-moving, heavy-footed text may carry the patient reader through to valuable conclusions, but an alert, quick style, if not overdone, will carry both the patient and the impatient on to conclusions which can be just as sound and valuable as those reached by plodding processes."

The ideas in your manuscript should be bound together so closely that readers can easily follow the progress of your thought from paragraph to paragraph. Often, you will find a transitional sentence useful. Sometimes a transitional word or phrase at the beginning of the paragraph will be sufficient.

A good way to improve your manuscript is to look at the first sentence of the first paragraph. Is it written as well as it might be written? If not, what can you do about it? What about the second sentence? By the time you have rewritten the first 2 or 3 paragraphs, you will be interested in going further, in trying to improve the whole manuscript. And you will find that the more you write, the easier you will find it.

By the time you have reached the end, you will find a way of concluding your discussion with an effective statement.

Guides for Writers

Many guides are available to help writers. This brief list may be of use. Several of the items cited were mentioned previously.

THE GOVERNMENT PRINTING OFFICE STYLE MANUAL. January 1953. (May be obtained from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Price $2.75, paper edition, abridged, $1.25.)

WEBSTER'S UNABRIDGED DICTIONARY or FUNK AND WAGNALLS or any good unabridged dictionary.

PLAIN WORDS: THEIR ABC, by Sir Ernest Gowers, New York, Alfred A. Knopf. 1955.

COLLEGE HANDBOOK OF COMPOSITION, by Edwin C. Woolley, Franklin W. Scott, and Frederick Bracher. Ed. 5. Boston, D. C. Heath & Co. 1955.

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AMERICAN-ENGLISH USAGE, by Margaret Nicholson, Oxford University Press, New York. 1957. (Based on Fowler's Modern English Usage.)

PREPARING STATISTICAL TABLES FOR PUBLICATION, by Viola E. Culbertson and Marguerite L. Higgins, U. S. Dept. Agr. Agriculture Handbook No. 121. April 1957.

Of course, you are not trying to make an economic report into a literary effort. You are trying to present in clear and direct language the research

material you have. In doing so, however, you may find that you have produced an article or report that will be what we in the Department of Agriculture refer to as a "best seller." This will not be entirely because of the subject matter of the report or article. The quality of your writing will help to make it so. Make no mistake about that.

For, as Harry E. Neal (*11*) has said, ". . . The writer is an artist who works with words instead of paints, and the words he chooses and the manner in which they are used make his creation good or bad. . . ."

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Effect of Weight-Period Selection on Measurement of Agricultural Production Inputs

By Ralph A. Loomis

Choice of weights is basic to construction of index numbers that are designed to measure change over time. The analysis in this article develops criteria for selection of weights and examines the results of using different periods as a basis for measuring change in the volume of selected inputs in farm production from 1910 to 1955. Laspeyres' weighted aggregative formula was considered the most appropriate formula for use in this analysis. Average cost rates were used as weighting units. The various indexes of combined inputs that are described here were developed for testing purposes. It is believed that the index of total farm inputs that will result when the aggregate production inputs of agriculture are measured and analyzed will differ substantially from any of the index-number series of selected agricultural inputs shown here. This paper is a report on the first phase of the project. It does not pretend to be an exhaustive study of the many problems that arise in the construction of an index of agricultural inputs. For instance, the problems associated with selection of weighting units and an index formula are not discussed. However, it is a reasonably thorough analysis of the problem of how to aggregate the different inputs in a meaningful way to show change over time when the composition, relative prices, and quantities of inputs change. *The advice and leadership of Glen T. Barton in the preparation of this article is acknowledged by the author.*

ONE of the main principles governing the choice of a weighting period is that the weights for that period reflect accurately the relative importance of the movements of the components of the index.[1] This is particularly true in the construction of an index of inputs measuring changes in recent years. Wage rates of hired labor relative to prices of other inputs, for example, now average more than double that of the pre-World War II period. Use of prewar wage rates as weights would greatly understate labor input and its effect on changes in the aggregate of inputs. This analysis will develop a basis for choosing weighting periods that will minimize distortions caused by changes in the relative importance of inputs.

Weighting agricultural inputs by prices paid in a given period, that is, changing from current cost rates to the average cost rates of a given period, essentially revalues the inputs for each year. Weighting and combining inputs raises the problem of changes in relationships among cost rates of labor, machinery, land, and so on, over time. Use of different periods of time for obtaining average cost rates results in different relative weights among input factors. This, in turn, usually results in different magnitudes of change in the indexes of combined inputs over the same span of years.

Once the price weights are selected, the resulting index will represent the average overall change from the base period of quantities of individual and total inputs in terms of the price relationships that existed in the price-weight period. A given index number has only one base period. The base period is the year or period that is taken as 100 in calculating the index number. The weight period, on the other hand, is the year or period selected for calculating average cost rates to be used as weights in combining component inputs. More than one weight period may be used. The series of years for which indexes are to be calculated may be divided into two or more subperiods, with weight periods selected for use in each subperiod. When this is done, splicing is necessary in calculating final index numbers.

Quantity-Price Aggregates

Systematic observation and tests of data show the comparative effects of alternative price-weight periods on changes in the index of total inputs. It is difficult to specify any point in time as a demarcation between periods in which the com-

[1] "Research in Agricultural Index Numbers," Social Science Research Council Bulletin No. 10, March 1938, was used as a general reference on the theory of index numbers.

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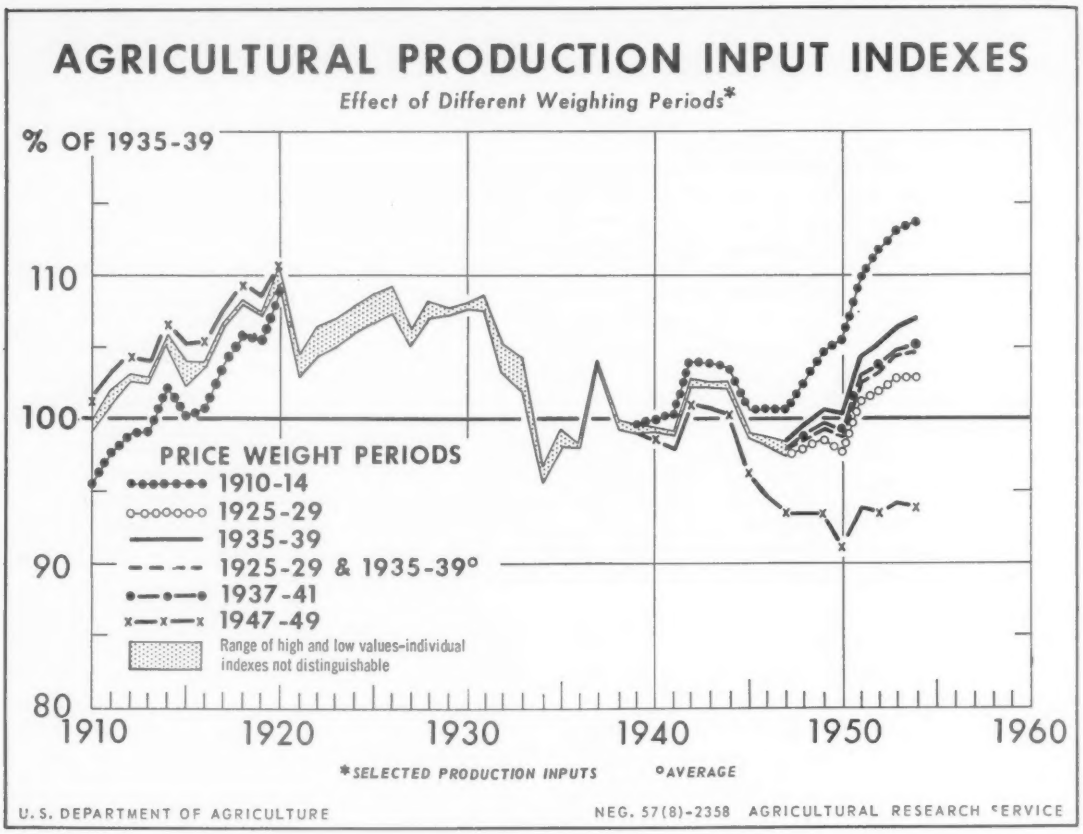

FIGURE 1.

position of inputs and the biases that result from relative price changes are sufficiently different to warrant separation.

In a critical examination of price and quantity data, the final test revolves around the effect of price weights on the composite index of inputs. This in turn is a function of changes in both quantity and price aggregates. Differences in indexes of combined inputs, resulting from use of different price-weight periods, may be seen in figure 1.

Selection of inputs for the evaluation of changes in indexes of combined inputs was based on the necessity of including a high percentage of the total inputs and using inputs for which data were readily available. Although the data used are tentative and subject to revision, the revisions are not likely to be of sufficient magnitude to invalidate the results of these tests. The selected inputs used for this analysis, which includes all the major inputs, are: All farm labor, farm machinery depreciation, motor vehicle depreciation, fertilizer nutrients, building depreciation, and net rent on farm real estate.

For selected price-weight periods, the general procedure in this analysis was to calculate quantity-price aggregates for each selected input, add them to obtain a total of selected inputs, and express this total as an index, with 1935–39=100. The price-weight periods tested were 1910–14, 1925–29, 1935–39, average of 1925–29 and 1935–39, 1937–41, and 1947–49.

The resulting indexes of total selected inputs for each price-weight period were plotted and analyzed for the entire 1910–54 period (fig. 1). It can be seen that regardless of the price weights used, after 1940 the indexes form a pattern that differs from the pattern before 1940.

The quantity-price aggregate data were analyzed in further detail to determine the effect of the different sets of price weights on the composite index. The results are given in table 1. The technique used is as follows: (1) The percentage that each input is of the total selected inputs was calculated for 1910–14, using weights provided by each of several weight periods (cols. 2 to 7); (2) the change in physical quantity of each input between 1910–14 and 1935–39 was calculated as a percentage (col. 8); and (3) the percentages resulting from steps 1 and 2 were multiplied, giving a percentage change for each input factor for each weight period (cols. 9 to 14). This latter percentage is a measure of the combined influence of changes in quantity of each input factor and each price-weight period on the final index of total inputs.

From the totals of columns 9 through 14 (table 1), it can be observed that using the weight periods of 1925–29, the average of 1925–29 and 1935–39, or 1937–41 would result in indexes of combined inputs within one point of each other, when indexes for the average of the years 1935–39 are calculated with 1910–14 as a base. Use of 1910–14 price weights would result in an index higher than, and 1947–49 price weights lower than, any of the indexes that would result from the use of the price-weight periods mentioned. These differences are largely the result of changes in the relative weight of motor vehicles, an input which increased substantially in physical quantity between 1910–14 and 1935–39 (see col. 8).[2]

[2] This report does not lend itself to a detailed discussion of weight-correlation bias, one of the limitations of weighted aggregate indexes. Nevertheless, it is important that the reader be aware of the effects on the composite index of changes in relative weights of inputs and changes in relative quantities of inputs. The accompanying table illustrates the effects of weight-correlation bias when the relative price weight of any given individual input is changed. For further information see the reference given in footnote 1.

Relative price weight	*Change in quantity of input*	*Contribution to "bias" of composite input index*
+	+	+
+	−	−
−	+	−
−	−	+
+	0	0, −, or +
0	+	0
−	0	0, +, or −
0	−	0

Based on the above evidence, any of the weight periods 1925–29, 1935–39, average of 1925–29 and 1935–39, or 1937–41 would be equally representative of the 1910–39 period.

The same test was applied, using the same weight periods but using 1918–22 as a base period and measuring change in the index of total selected inputs from 1918–22 to 1935–39. Essentially the same patterns were evident.

The effects of different weighting periods on relative weights and on changes in the composite index of inputs were also evaluated with reference to the 1940–55 period. The weight periods tested were 1935–39, 1937–41, 1947–49, and 1952–54. In one test, 1935–39 was used as a base period, with measurement of changes in physical quantities of inputs between 1935–39 and 1950–54. A second test was made, using 1939–41 as a base period and changes in physical quantities between 1939–41 and 1952–54.

In the period 1940–55, all selected inputs except labor increased in physical quantity. The exception (labor) decreased. Use of either 1935–39 or 1937–41 price weights results in overweighting all the inputs, except net rent, relative to labor. Fertilizer is particularly overweighted relative to labor by the use of pre-World War II weights. Use of the 1952–54 price weights tends to overweight labor relative to the other inputs. Although 1947–49 price weights also overweight labor, they do so to a lesser degree than 1952–54 weights. The overweighting of labor, an input which is decreasing in physical quantity, results in a slight downward bias in the composite index of inputs.

Based on this evaluation, 1947–49 is the most suitable weight period for 1940–55.

Relative Price Movements

In evaluating price weights, another technique used was to compare the movement of various input prices relative to the movement of farm wage rates. Wage rates were used as the basis for comparison because labor is the largest single input, and also as a matter of convenience. The comparison was expressed as a ratio of indexes of input prices to the wage-rate index. If the comparative movements of wage rates and other inputs were exactly equal from year to year, the ratio of the indexes would be equal to 100, for by

TABLE 1.—*Effects of different weighting periods on relative weights and on changes in the index of selected physical inputs (1910–14 base period)*

Inputs	Percentage of value of total inputs in 1910–14 period using as weights						Change in physical quantity, 1910–14 to 1935–39	Change in inputs from 1910–14 to 1935–39 using as weights					
	1910–14 prices	1925–29 prices	1935–39 prices	Average of 1925–29 and 1935–39 prices	1937–41 prices	1947–49 prices		1910–14 prices	1925–29 prices	1935–39 prices	Average of 1925–29 and 1935–39 prices	1937–41 prices	1947–49 prices
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Labor [1]	61. 78	66. 20	65. 77	66. 05	65. 66	70. 88	−9. 33	−5. 76	−6. 18	−6. 14	−6. 16	−6. 13	−6. 61
Farm machinery depreciation [2]	3. 16	2. 89	4. 06	3. 37	3. 76	2. 04	−26. 38	−. 83	−. 76	−1. 07	−. 89	−. 99	−. 54
Motor vehicle depreciation [2]	. 59	. 25	. 36	. 30	. 34	. 21	+943. 55	+5. 57	+2. 36	+3. 40	+2. 83	+3. 21	+1. 98
Building depreciation [2]	4. 21	4. 23	5. 03	4. 59	4. 79	3. 84	−14. 09	−. 59	−. 60	−. 71	−. 65	−. 67	−. 54
Fertilizer [3]	2. 86	2. 10	2. 20	2. 13	1. 98	. 89	+47. 36	+1. 35	+. 99	+1. 04	+1. 01	+. 94	+. 42
Net rent [4]	27. 40	24. 33	22. 58	23. 56	23. 47	22. 14	+6. 38	+1. 75	+1. 55	+1. 44	+1. 50	+1. 50	+1. 41
Total	100. 00	100. 00	100. 00	100. 00	100. 00	100. 00		+1. 49	−2. 64	−2. 04	−2. 36	−2. 14	−3. 88

[1] Estimates based on data in: Changes in Farm Production and Efficiency, USDA–ARS 43–15, June 1955; The Farm Income Situation, USDA–AMS, No. 155, Oct. 1955; Farm Labor, USDA–AMS, Jan. 1956; and unpublished manuscript by E. W. Grove, Farm Income Estimates Section, AMS, USDA.

[2] Estimates based on data in: Worksheets of Farm Income Estimates Section, AMS, USDA.

[3] Estimates based on data in: Worksheets of Farm Income Estimates Section, AMS, USDA; PERB No. 3, ARS, June 1954; and Changes in Farm Production and Efficiency, USDA, ARS 43–15, June 1955.

[4] Estimates based on data in: Worksheets of Land and Water Section, FERD, ARS.

definition the price index of each input and of wage rates is equal to 100 in the base period. The period of years deviating the least on the average from 100 would be the one in which the relative prices of inputs was most stable.

The above ratios were plotted on charts for indexes based on both 1925–29 and 1935–39 (figs. 2 and 3). It was evident that 1925–29 price weights would underweight wage rates relative to other inputs, while 1935–39 price weights would overweight wage rates relative to all other inputs except land, considering the period 1910–39 as a whole. A numerical tabulation of the magnitude of the overweighting and underweighting indicated that 1935–39 price weights would be preferable to 1925–29 weights. The 1935–39 weights would overweight to a lesser degree than the 1925–29 weights would underweight (table 2).

Averages of Prices Paid Indexes

Prices-paid indexes (1935–39=100) were further evaluated by comparing the simple arithmetic averages of alternative weight periods with the average of the price indexes for the entire 1910–39 period (excluding two periods of unusual economic activity—1917–21 and 1931–34). The weight periods tested in this way were 1925–29; 1935–39; average of 1925–29 and 1935–39; and 1937–41.

The deviations of the weight-period averages from the 1910–39 averages were weighted on the basis of the relative importance of each input to total inputs. The weight period with the least deviation would be the most representative of the 1910–39 price index series. Based on this test, either the 1935–39, 1937–41, or the average of

TABLE 2.—*Ratio of indexes of input prices to wage rate index, 1910–40* [1]

Selected inputs	1925–29=100		1935–39=100	
	1910–40 average of the ratio	Average deviation from 100	1910–40 average of the ratio	Average deviation from 100
Feed	118	+18	99	−1
Livestock	107	+7	86	−14
Motor supplies [2]	114	+14	95	−5
Motor vehicles [2]	142	+42	84	−16
Farm machinery	122	+22	81	−19
Farm supplies	115	+15	93	−7
Building and fencing materials	118	+18	86	−14
Fertilizer	122	+22	104	+4
Real estate value per acre [3]	117	+17	134	+34

[1] The Farm Cost Situation, FCS–15, October 1953–March 1954, BAE for Indexes of Prices Paid (1935–39=100).
[2] Price paid indexes available only for the years 1924–40.
[3] Worksheets, Land and Water Sections, Farm Economics Research Division, ARS.

1925–29 and 1935–39 would serve equally well as price-weight periods. The 1925–29 period would be the least representative of the periods tested.

Most of the price-index evaluation thus far has been with reference to the 1910–39 period. Essentially the same techniques were applied to several weight periods with reference to the 1940–55 period. Prices for the periods 1935–39, 1946–50, 1947–49, and 1952–54 were tested to determine the representativeness of each to the 1940–55 span of years.

Observations of the movements of prices paid for inputs indicated 1947–49 to be the most representative price-weight period. Although it is slightly high relative to the 1940–55 period, it is not seriously so.

Slightly less emphasis was placed on testing the weight periods for the 1940–55 period because considerable analysis has been previously directed toward this problem. Nevertheless, alternatives were evaluated and price indexes scrutinized to determine the validity of 1947–49 as a price-weight period to be used in the construction of an input index.

Price Level of Inputs

Although price level, as such, would have no effect on the relative magnitude of index numbers, there is ample evidence of association between changes in price level and changes in the relative prices of component inputs. In periods of rapidly changing price levels, either up or down, there is likelihood of greater disequilibrium among component prices than during periods of relative price-level stability. One criterion, therefore, in selecting a price-weight period is to select a period most representative of the level of prices for a span of years or a relatively stable price period. During such a price-level period, the relative prices of inputs will approach the maximum degree of equilibrium attainable in a dynamic setting.

The indexes of prices paid that were used in this analysis includes those for farm labor, farm machinery, motor vehicles, motor supplies, farm supplies, building and fencing materials, fertilizer, feed, and land value per acre.[3] Comparison was made of the movements over time of the prices-paid indexes of each individual input. Indexes with bases of both 1925–29=100 and 1935–39=100 were examined.

This simple comparison of indexes lends support to the division of the 1910–55 period into at least two distinct periods, for at approximately 1940 the level of prices swings materially upward as compared with most of the period before 1940. There is also some indication that pre-World War I prices are relatively low for some inputs.

Evaluation of Weight-Period Testing

The results of the tests are summarized first with reference to 1910–39 and 1940–55. Then some observations concerning two possible subperiods, 1910–19 and 1920–39, are presented.

The general conclusions for the period 1910–39 are as follows:

1. Based on an examination of plotted indexes of prices paid for individual selected inputs, 1925–29 or 1935–39 appear to be equally suitable as weight periods.

2. Examination of the ratio of indexes of prices paid for individual inputs to the wage-rate index reveals that 1935–39 price weights are preferable to 1925–29 price weights.

3. The comparison of the average of price indexes of individual inputs for given weight periods to the average

[3] *Agricultural Prices*, Agricultural Marketing Service, October 28, 1955; *Farm Labor*, January 1956; unpublished manuscript by E. W. Grove, Farm Income Estimates Section, Agricultural Marketing Service, and Worksheets, Land and Water Section, Farm Economics Research Division, ARS.

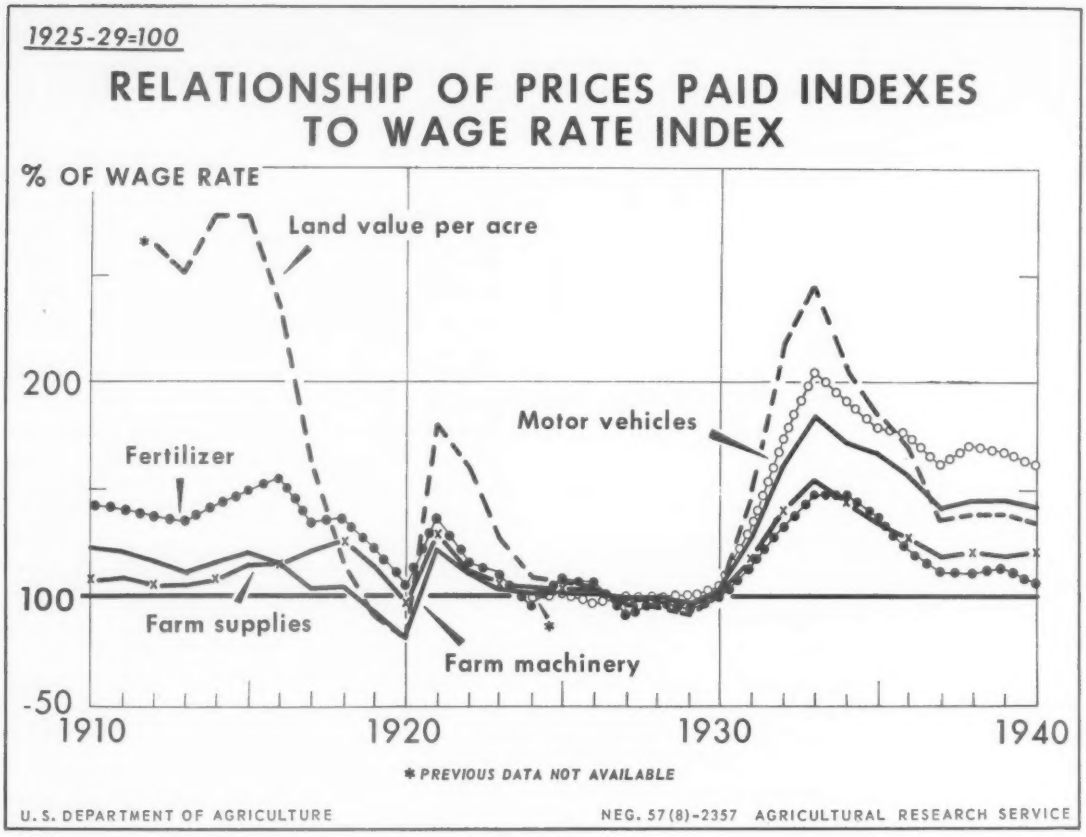

FIGURE 2.

of price indexes of individual inputs for the entire span of years indicates that the average of the two periods, 1925–29 and 1935–39, is most representative for the 1910–39 period. The period 1937–41 would be second choice, 1935–39 third, and 1925–29 fourth.

4. The evaluation of quantity-price aggregates and of indexes based on them, for selected inputs, is a superior test compared with evaluation of price indexes alone. Each of the following weight periods—1925–29, 1935–39, average of 1925–29 and 1935–39, and 1937–41—would result in an aggregate index of inputs of essentially equal magnitude. The periods 1910–14 or 1947–49 would not be as suitable as the weight periods mentioned. This test shows the effect of alternative price-weight periods on the *final composite* index of selected inputs. A further evaluation of quantity-price aggregates, as illustrated in table 1, sheds additional light on the effect of different weight periods by showing the relative weights of individual inputs and their effects, when different weight periods are used. The conclusions drawn from this technique agree with those stated above.

The conclusion is reached that there are several weight periods that could be used for the 1910–39 period without appreciably affecting the index of aggregate inputs. None of the weight periods is perfect. Indeed none of them could be perfect.

The 1935–39 period has advantages that fall outside the realm of statistical testing. This period was relatively free from major economic influences of war, deep depression, or high inflation. Thus, for the most part, it was free from relative price distortion associated with high and low price-level periods. Much of the basic data needed in constructing indexes are available in terms of 1935–39 dollars. These data materially reduce time and cost considerations. Also of major importance is the fact that the Farm Economics Research Division, Agricultural Research Service index of farm output uses 1935–39 weights for 1910–39. Thus

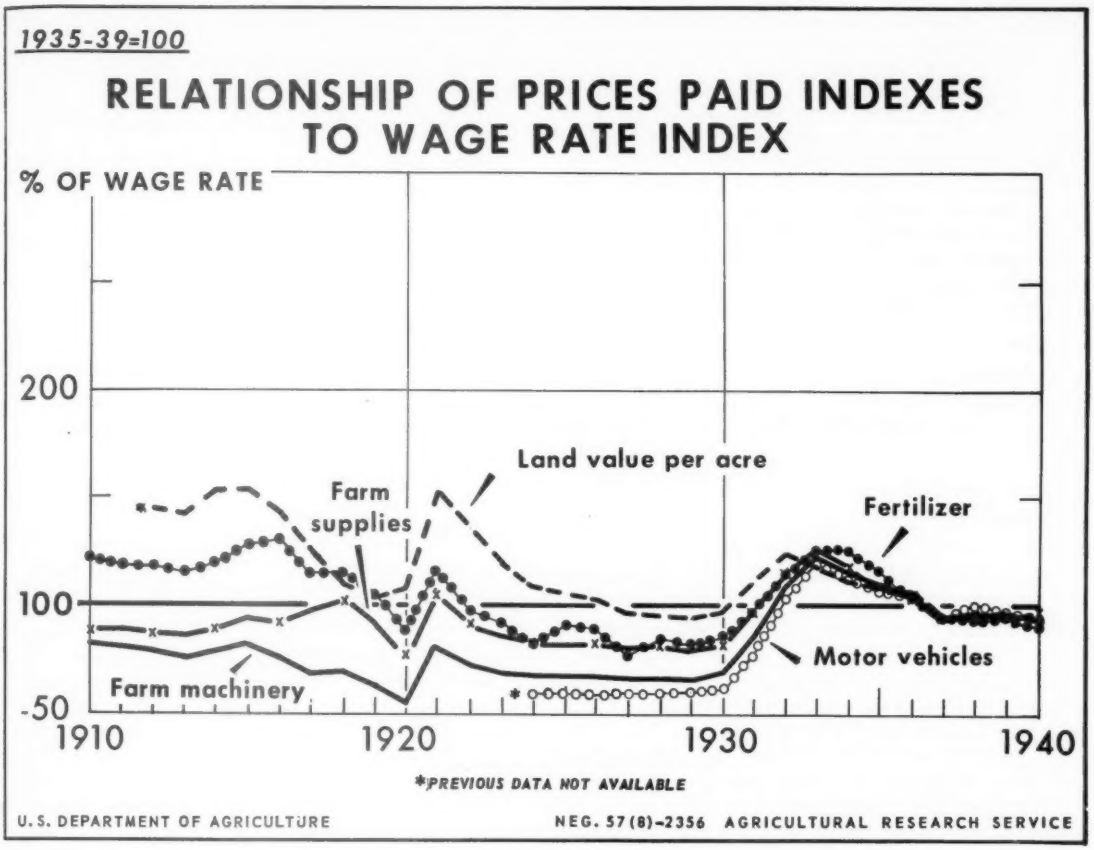

FIGURE 3.

use of 1935–39 price weights for the input index will facilitate later analysis of changes in the relation of inputs to output.

The general conclusions for the 1940–55 period are as follows:

1. Based only on price indexes of individual inputs, 1947–49 price weights are more representative of the period than are 1935–39 or 1952–54 price weights.

2. From the comparison of price index averages of given weight periods to the average of the entire period, 1946–50 price indexes vary least from the 1940–55 average. Second choice would be 1947–49, third 1952–54, and fourth 1935–39.

3. Comparing the relative movements of the individual input indexes to the wage-rate index dictates the use of 1947–49 price weights in preference to others.

4. The evaluation of quantity-price aggregates and indexes based on them suggests that 1947–49 and 1952–54 price weights would serve equally well for the composite index for the 1940–55 period. Average 1935–39 weights would not be representative of this period. The 1947–49 weight period would result in the smallest bias in the composite index of inputs.

The conclusion can be reached that 1947–49 is the soundest weight period for 1940–55. It is not perfect, but the degree of its limitations is relatively insignificant for a macro-economic analysis of total agricultural production inputs for 1940–55. The use of 1947–49 price weights will facilitate also input-output analysis as the Farm Economics Research Division, Agricultural Research Service output series uses 1947–49 weights for the 1940–55 period.

It is clear from the preceding analysis that the 1910–55 period should be divided into at least two periods for the purpose of constructing an index of agricultural inputs. There is also some evidence that the 1910–19 period had characteristics that may warrant separating it from the 1920–39

period. Following are some observations and results of limited testing concerning 1910–14 price weights for the 1910–19 period:

1. The relative degree of mechanization heads the list of major changes between the 1910–19 decade and the years that follow. The introduction of automobiles, motortrucks, and tractors did not reach major proportions in the farming scene until after 1920.

2. The turning point of an era of expansion through adding of acreage, in favor of an era of intensification, was about 1920.

3. The price structure for agriculture in the pre-World War I period, was at a lower level than in the period that followed the war.

4. By testing the effect of different weight periods on the composite index of inputs over the period 1910–19, it was ascertained that a difference of one point would result as between using 1910–14 or 1935–39 price weights.

The evidence presented here is not sufficiently conclusive to warrant a decision as to whether to use 1910–14 price weights for the 1910–19 period or to use 1935–39 price weights for the entire 1910–39 period. The final decision on this period will await further analysis.

Measuring the Relative Influence of Acreage and Yield Changes on Crop Production

By S. M. Sackrin

Agricultural economists and others engaged in agricultural research frequently have occasion to analyze the effect of changes in acreage and yield on crop production. This article describes a method of deriving statistical measures that summarize the relative influence of acreage and yield changes, respectively, on year-to-year variation in production. This method is applied to an analysis of several major crops to illustrate how the effect on production of changes in acreage and yield may be evaluated.

IT IS AXIOMATIC that the production of any crop is the direct consequence of number of acres harvested and average yield per acre. But frequently the question arises: Are changes in acreage or changes in yield more instrumental in causing variation in production normally experienced from year to year?

Answers to this question have been advanced for corn and wheat. Foote, Klein, and Clough say: "About 80 percent of the year-to-year variation in corn production in the United States during the period 1919–48 resulted from changes in yield per acre."[1] In the case of wheat, Meinken writes: "From 1920 to 1938, changes in wheat acreage had much less effect on production than did changes in yield. Since 1938 the influence of acreage change has almost equaled that of yield."[2]

[1] FOOTE, RICHARD J., KLEIN, JOHN W., AND CLOUGH, MALCOLM. THE DEMAND AND PRICE STRUCTURE FOR CORN AND TOTAL FEED CONCENTRATES. U. S. Dept. Agr. Tech. Bull. No. 1061, 79 pp., illus., 1952. p. 14.

[2] MEINKEN, KENNETH W. THE DEMAND AND PRICE STRUCTURE FOR WHEAT. U. S. Dept. Agr. Tech. Bull. No. 1136, 93 pp., illus. 1955. p. 33. The last year included in Meinken's analysis is 1954.

Foote, Klein, and Clough do not give the full details of their computations, but the relative contribution of changes in corn yields apparently was ascertained as follows:

1. The average year-to-year change in yield (disregarding signs) was expressed as a percentage of the average yield for the period.

2. The average year-to-year change in acreage (disregarding signs) was expressed as a percentage of the average acreage for the period.

3. The two percentages were added. The result obtained in step 1 was then expressed as a percentage of this sum.

Retracing the computations in this way gave a percentage of 83.5, which is presumed to be the approximate 80 percent mentioned by the authors.

Limitations of Methods Previously Used

Although this approach may give a close approximation of the answer sought, its drawback is that it fails to equate strictly changes that take place in acreage and yield with changes in production. In other words, the sum of the results obtained in steps 1 and 2 described above fail to

add to the percentage obtained by expressing the average year-to-year change in production as a percentage of average production during the period. The basic reason, of course, is that elements of a multiplicative relationship were added, yielding a final result that is no longer precisely equated.

A similar limitation exists in the approach used by Meinken. In the method he used, the "direct effect of yield" is learned by multiplying the change in yield from one year to the next by the acreage of the earlier year. The "direct effect of acreage" is learned by multiplying the change in acreage from one year to the next by the yield of the earlier year. However, the sum of these direct effects does not exactly equal the actual change in production. The difference is referred to as an "interaction term"—the product of the two changes.

Though the approach used by Meinken also fails to equate directly changes in acreage and yield to changes in production, a useful feature is that the relative contribution of acreage and yield changes to production, year by year, may be evaluated. However, it does not provide summary measures of the relative influence of the production determinants during any specified period, unless the yearly "direct effects" are averaged.

Proposed Computational Method

Such summary measures may be obtained by applying the simple mathematical principle that a multiplicative relationship expressed in natural numbers becomes an additive relationship when expressed in logarithms. Hence, the relationship

$$P=A\times Y$$

where P=production, A=acreage harvested, and Y=average yield per acre
becomes

$$\log P=\log A+\log Y \qquad (1)$$

When expressed as first differences of logarithms, to get changes from the preceding year, the equation becomes:

$$\Delta \log P=\Delta \log A+\Delta \log Y \qquad (2)$$

Unlike the two approaches already described, the equality of both sides of the equation is preserved in the sums.

A least-squares regression is computed, with $\triangle \log P$ as the dependent variable X_1, and $\triangle \log A$ and $\triangle \log Y$ as the independent variables X_2 and X_3, respectively. The only statistical coefficients required are—and this is important—b_{21} and b_{31}.[3] Their sum will exactly equal 1.00. The coefficients may be interpreted as follows: On the average, of each 1-percent change in production from the preceding year, — percent is ascribable to X_2 (acreage changes) and — percent is ascribable to X_3 (yield changes). This follows because the coefficient b_{21} measures the change in X_2 associated with a one-unit change in X_1, while the coefficient b_{31} measures the change in X_3 associated with a one-unit change in X_1. As the data are expressed in first differences of logarithms, the unit change involved here is a 1-percent change from the preceding year. This unit change is the exact sum of the changes in the two determining variables, hence the coefficients b_{21} and b_{31} represent the proportion that each comprises of the total.[4]

Comparison of Results Obtained by Alternative Methods

To learn whether results obtained from the three methods differ, each was used in an analysis of the relative influence of acreage and yield changes on

[3] Although equation (2) implies that we desire net regression coefficients on acreage and yield, for the purpose in hand we are interested only in the simple regression coefficients b_{21} and b_{31}. The net regression coefficients $b_{12.3}$ and $b_{13.2}$ will, of course, each be 1.00, as the unit change in production will exactly equal the unit change in either independent variable, with one independent variable held constant.

[4] This approach is basically a variation of that described by Foote and Fox to analyze the effects of changes in production on the alternative outlets—domestic consumption, net exports, and net changes in stocks. (Foote, Richard J., and Fox, Karl A. Analytical tools for measuring demand. U. S. Dept. Agr. Agr. Handb. 64, 86 pp., illus., 1954. p. 8). Foote and Fox suggest a series of simple least-squares regressions with production the independent variable, and each outlet as dependent variables. Because this formulation places production on the right side of the equality sign, the coefficient b_{12} is the meaningful measure, and their sum will equal 1.00, as the authors point out. The method proposed here modifies this approach by (1) using a logarithmic formulation to convert a multiplicative relationship to an additive one, and (2) treating production as the dependent variable in a three-variable regression analysis, and considering the simple coefficients b_{21} and b_{31} (which are equivalent to the individual b_{12}'s derived in the Foote-Fox approach).

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TABLE 1.—*Relative effects of changes in acreage and yield on year-to-year changes in production of flue-cured and burley tobacco, 1944–56, as computed by alternative methods*

Method [1]	Percentage of year-to-year variation in production ascribable to—			
	Acreage changes		Yield changes	
	Flue-cured	Burley	Flue-cured	Burley
	Percent	*Percent*	*Percent*	*Percent*
1	60	49	40	51
2	59	48	41	52
3	80	56	20	44

[1] See text for explanation of methods.

year-to-year variation in the production of flue-cured and burley tobacco during the period 1944–56. Designating the method used by Foote, Klein, and Clough as Method 1, that used by Meinken as Method 2, and that proposed here as Method 3, the results were as shown in table 1.[5]

This comparison indicates that use of Methods 1 and 2 yield similar results, but they differ substantially from those obtained from Method 3. In this particular instance, Methods 1 and 2 fail to indicate the predominant influence of acreage changes on burley production during this period, and understate the influence of acreage changes on flue-cured production.

As a further test, an analysis was made of the relative influence of changes in acreage and yield on potato production during the period 1940–55. Use of Methods 1 and 2 gave similar results, but although they indicated the predominant influence of acreage changes, they attributed 58 to 61 percent of total year-to-year variation in production to that source, compared with 67 percent for Method 3.

[5] Meinken does not give summary measures for the entire period reviewed, but presents a chart showing the "direct effects" of acreage and yield changes year by year. In the illustration discussed here, the following computations were made to obtain summary measures which can be compared with those yielded by the other methods considered: (1) The "direct" effects of each were averaged for the period, disregarding direction of change. (2) The average "direct effect of acreage" and the average "direct effect of yield" were then each expressed as a percentage of their sum.

TABLE 2.—*Relative effects of year-to-year changes in acreage and yield on year-to-year changes in production of specified crops, 1921–56*

Crop	Period			
	1921–38		1939–56	
	Effect of acreage changes	Effect of yield changes	Effect of acreage changes	Effect of yield changes
	Percent	*Percent*	*Percent*	*Percent*
Wheat	42	58	64	36
Cotton	39	61	71	29
Soybeans [1]	[2] 73	[2] 27	61	39

[1] For beans.
[2] Period considered is 1925–38.

From this, the conclusion would appear to be as follows: Use of Methods 1 or 2 may give a quick approximation of the relative influence of acreage and yield changes on production, but there is a danger that they may erroneously indicate a factor as the more influential one. If the analyst wishes a more precise delineation of the relative contribution of each of the two determinants to production changes, the additional work entailed in Method 3 would appear to be justified.[6] But it should be remembered that this method gives the *average* relative contribution of acreage changes and yield changes to year-to-year variation in production. If extreme changes occur in a few years included in the period, the coefficients obtained are affected accordingly. For example, an analysis of the two determinants in burley tobacco production for the period 1944–54 showed that 53 percent of the year-to-year variation in output was attributable to yield changes and 47 percent to acreage changes. If the period 1944–56

[6] Much of the computational labor consists of obtaining the logarithms and computing the first differences. After the first differences of logarithms are determined and balanced, the coefficients may be obtained as follows:

$$b_{21}=\frac{\Sigma x_1x_2}{\Sigma x_1^2} \text{ where } \Sigma x_1x_2=\Sigma X_1X_2-\overline{X}_2\Sigma X_1 \text{ and}$$

$$\Sigma x_1^2=\Sigma X_1^2-\overline{X}_1\Sigma X_1$$

$$b_{31}=\frac{\Sigma x_1x_3}{\Sigma x_1^2} \text{ where } \Sigma x_1x_3=\Sigma X_1X_3-\overline{X}_3\Sigma X_1$$

It will be noted that $\Sigma x_1^2=\Sigma x_1x_2+\Sigma x_1x_3$.

is considered, however, the measures of relative contribution change to 56 percent for acreage changes and 44 percent for yield changes. The reason is that, owing to a sharp cut in allotments in 1955, harvested acreage dropped from 421,000 to 311,000 acres, a decline of 26 percent. Average yield per acre changed only 5 percent, declining from 1,586 pounds to 1,513 pounds.

Illustration of Use of Proposed Method

Method 3 was used to ascertain the relative effects of acreage and yield changes on year-to-year changes in production of cotton, wheat, and soybeans during the periods 1921–38 and 1939–56. The crops and the periods were selected to illustrate application of the proposed computational method; analysts who are working in these commodity areas may wish to examine other periods. Results of the analysis are shown in table 2.

Results for wheat confirm Meinken's finding that yield changes exerted the predominant influence on yearly changes in production in the period 1920–38. For the period following 1938, however, results show a greater influence of acreage changes than was found by Meinken, probably because of inclusion of 1955, when harvested acreage declined substantially from the previous year.

The analysis of cotton showed that in the period 1921–38 approximately 60 percent of the annual changes in production was attributable to changes in yield. In 1939–56, this contribution dropped to about 30 percent, whereas that of acreage changes rose to about 70 percent. During the more recent period, there were sharp fluctuations in harvested acreage of cotton, particularly in 1947, 1949, 1950, 1951, and 1954, when annual changes ranged from 20 to more than 50 percent. These sharp changes were chiefly the result of a postwar expansion in acreage and the operation of acreage controls in 4 of the 7 years 1950–56.

In the case of soybeans, the analysis showed that in both periods acreage changes were the predominant influence on changes in yearly production, but that the relative contribution of changes in yield was greater in the more recent period than in the earlier one.

Preliminary Report on Objective Procedures for Soybean Yield Forecasts

By Bruce W. Kelly

As part of its expanded research program, the Agricultural Estimates Division of AMS is exploring the possibilities of objective forecasts of yield for several crops. This paper summarizes results obtained from the first year's work on soybeans. Although these results must be regarded as tentative until more data become available, they nevertheless illustrate how the problem is being attacked.

TO DEVELOP TECHNIQUES for forecasting the yield of a crop, it is convenient to study individual components of yield separately. In our study of soybeans, the components considered were the number of plants per acre, the number of pods per plant, and the weight of beans per pod.

This preliminary report is restricted to forecasting the number of pods per plant that will reach maturity and be present on the plants at harvest time, based on 1956 data. As the number of plants per acre can be estimated from sample plots within fields, this is equivalent to forecasting the number of pods per acre.

As for cotton, a forecast made early in the season must allow for fruit not yet on the plants.[1] This is the situation with soybeans on August 1, which is the earliest forecast date considered here. The general approach used in this study was the same as for cotton—namely, to count the pods already present on August 1 and to seek an observable syndrome of plant characteristics that indicates what fraction of a 100-percent load is represented by that count. Again, as with cotton, all pods that will contribute to the final yield have

[1] See HENDRICKS, WALTER A., and HUDDLESTON, HAROLD F. OBJECTIVE ESTIMATES OF COTTON YIELD. Agricultural Economics Research. 9:20–25. 1957.

been formed by September 1. On and after that date, the problem is reduced to estimating the fraction that will survive and reach maturity. (The problem of estimating normal harvesting losses is not considered in this report.)

Two sets of data were available for this study. For the first set, intensive counts of bloom and pod were made at frequent intervals between June 28 and September 11, 1956, on 3 plants in each of 12 Illinois soybean fields near Springfield. This field work was done under direction of the State statistician's office in Springfield. These counts were used to study the growth and fruiting habit of the soybean plant, and to set up a forecasting model. A second set of fruit counts was available from a probability sample of 150 soybean fields dispersed over the producing area in the North Central States. In those fields, counts were made at monthly intervals during 1956 from August 1 until harvesttime. (Only half of these fields were used on August 1.) Relationships derived from the Illinois data were applied to data from the more extensive surveys in the North Central States to test the accuracy with which the final mature pod count could be forecast at the official monthly forecast dates, starting with August 1.

Relationships Observed in Illinois Data

For each plant on which detailed counts could be made throughout the entire growing season, the number of pods present on each date was expressed as a percentage of the maximum number formed on any later date. As there was some variation in the date on which the maximum pod load was attained, the time scale was adjusted so that August 5 was arbitrarily substituted for the actual date. The dates of the other observations were adjusted accordingly. This had the effect of putting the pod counts on a comparable age-of-plant basis. Average percentage of maximum pod load by adjusted dates after these adjustments were made is shown in table 1.

Plotting the relative pod load against time on a chart shows that the decline in pod load proceeds in almost linear fashion after the maximum is reached. The rate of pod formation up to the maximum count follows a typical sigmoid growth curve. The problem in that part of the fruiting history of the plant is to find some observable plant characteristics that are related to the relative pod load so that when pods are counted it will also be possible to ascertain the fraction of a full load that the count represents.

TABLE 1.—*Pod load on soybean plants as percentage of maximum load (Illinois data)*

Adjusted date	Pod load
	Percent
June 28	0. 0
July 11	6. 2
July 17	20. 2
July 28	81. 0
August 5	100. 0
August 28	87. 5
September 11	77. 1

The Illinois data indicate that plants have their maximum number of blooms about 2 weeks after blooming begins. Pods begin to set at that time. About 2 weeks later, plants carry about half of their fruit as blooms and half as pods. The older pods have already reached full length. In terms of blooms and pods combined, the plant has its maximum fruit load 1 week later, and the presence of beans can be detected in the older pods. Another week later—this would be 4 weeks after pods begin to set—the plant is carrying its maximum number of pods. By the time flowering ceases—about 3 weeks after the maximum pod load has been attained—the plant has shed 13 percent of its pods. Another 16 percent of the pods disappear between cessation of blooming and maturation of pods, so that only about 71 percent of the pods present at the date of maximum pod load are present at harvesttime.

On the basis of these observations, it was concluded that plants on which no pods have yet begun to set at the time of an early-season forecast date, such as August 1, have 0 percent of their maximum pod load; the average plant carrying more blooms than pods has 15 percent of that maximum; the average plant carrying more pods than blooms, but no pods yet showing bean formation, has 75 percent of its maximum; and the average plant showing pods with beans, even if blooms are also present, already has 100 percent of its maximum total per load.

This tentative relationship between observable plant characteristics and relative pod load was applied to August 1 data from extensive surveys conducted over the soybean-producing areas of 11 North Central States. Losses of pods between the

TABLE 2.—*Computation of average percentage of full load present on August 1*

	Relative number of fields	Percentage of maximum pod load
	Percent	*Percent*
No pods set	11	0
More blooms than pods	24	15
More pods than blooms	37	75
Some pods having beans	28	100
Weighted average	100	59. 4

date on which the maximum count was reached and harvesttime were also assumed to be of the same relative size as in the Illinois data.

Analysis of Data From North Central States

Observations in the North Central States were made at monthly intervals on two sample plots in each sample field. Each plot consisted of two adjacent row sections, 3 feet in length. All soybean plants were counted in each plot, but pods were counted on only 1 of the 2 row sections in each plot. Detailed counts of blooms, pods, nodes, and lateral branches were made on one plant adjacent to each row section on which pods were counted. These detailed counts were used to classify fields by stage of maturity into the categories suggested by the Illinois data. This classification was used to estimate the percentage of the maximum pod load that was reprsented by the August 1 pod count.

The classification of fields, the relative pod load for each class, and the weighted average relative pod load for all fields in the survey, are shown in table 2.

In the August 1 survey, the average pod count was 798 per 6 feet of row. The corresponding counts on later surveys were 1,198 on September 1 and 946 on October 1.

As of August 1, the maximum pod count that would be obtained can be forecast by dividing the observed count on that date by the fraction of a full load represented by that count: 798/0.594= 1,343. This is larger than the number observed on September 1, but the Illinois data indicate that about 13 percent of the maximum pod load is lost between August 1 and September 1. The number of pods expected to be present on September 1 should be (0.87) (1,343)=1,168 per 6 feet of row. This agrees remarkably well with the 1,198 actually observed on September 1. Again, according to the Illinois data, the number of pods found on October 1 should be about 29 percent less than the maximum: (0.71) (1,343)=954. This also agrees closely with the 946 actually counted on October 1.

It thus appears that a forecast of the number of pods that will be present at harvest time can be made as early at August 1. That forecast is obtained in two stages. First, the maximum potential pod load is computed from the number already present and the indicated percentage of a full load represented by that count. The number of these pods that will be present at harvesttime is then computed from the average survival rate.

By September 1, most plants have stopped blooming, very few new pods are being formed, and beans are developing in most pods on the plants. For a September 1 forecast of pods present at harvesttime the problem is mainly to estimate subsequent losses. These losses can be estimated from trends such as those observed in the Illinois data. But there may be other possibilities. For example, it was observed that for plants that have stopped blooming by September 1, the ratio of the October 1 pod count to the September 1 count was identical with the ratio of the September 1 count of pods with beans to the September 1 total pod count. For the region as a whole, the October 1 pod count was 79.0 percent of the September 1 count. The September 1 ratio of pods with beans to total pods was 80.9 percent. The agreement is also fairly good when considered State by State. This implies that plants mature enough to stop blooming at that stage, are carrying all pods that will produce beans and that pods in excess of that number are likely to be shed by the plants.

Experimental work is continuing to test the validity of the relationships described here and to seek possible refinements. For the August 1 forecast, some other basis for classifying plants according to maturity may be more suitable. For the September 1 forecast, the behavior of some plants that are still setting pods needs to be studied. Weight of bean is receiving attention. Harvesting losses are being estimated by gleaning sample fields after harvest.

Book Reviews

A Revision of Demand Theory. By J. R. Hicks. Oxford: Clarendon Press. 196 pages, illus. 1956. $3.75

IN THIS WORK, Hicks indicates that the demand theory he is revising is that of the first three chapters of *Value and Capital*, published in 1939. This theory of demand is developed in an econometric frame of reference, but follows the previous book in a nonmathematical formulation which will be welcomed by many economists.

Basic theoretical conclusions remain intact under this careful reappraisal, though the development differs to a considerable extent. In the technique of illustrating the preference hypothesis there is a notable change. In *Value and Capital*, Hicks starts with a simple 2-good case and illustrates a given scale of preferences with indifference curves. In his *Revision* he takes an alternative approach, which he regards as having the advantage of clarifying the preference hypothesis itself while avoiding the limitations of the earlier geometric presentation. The alternative method allows more rigorous exposition of demand theory in nonmathematical terms.

The first part of this three-part work—entitled "Foundations"—provides the framework for the sections that follow by dealing with (1) the demand for a single commodity, and (2) the general theory of demand. The logic of ordering receives systematic treatment, as demand theory, based on the preference hypothesis, boils down to an economic application of this logic. The distinction made between "weak" and "strong" ordering has important implications for the development that follows. If a consumer has a definite preference for position A over B, B over C, and so on, we may say that the ordering is strong; on the other hand, if two (or more) positions have equal appeal, the ordering is weak. Samuelson's development of consumption theorems in terms of revealed preference are of the "strong" ordering nature, as contrasted with the "weak" ordering of indifference positions.

The nature of the demand curve is explored by dividing the effect of a price change into the income and substitution effects. In considering the income effect, Hicks employs the Samuelson approach—he calls this method the cost difference. The comparison between this method and that of compensating variation, used in his earlier book, is especially helpful to the reader who is aware of both approaches. The method of compensating variation is employed throughout, especially for the analysis of substitution effects of change in price.

Throughout the book are graphic illustrations of the various concepts of demand curves. These aid greatly in comparing the approaches of cost difference and compensating variation. Hicks considers the demand curve of Marshall as uncompensated for income effects, Friedman notwithstanding. He distinguishes between the type of compensated curve for price declines and increases, and indicates the type of cost difference associated with each.

We usually think of the demand curve as indicating the quantity that consumers will take at given prices, and most theory is oriented to this price-into-quantity approach. Hicks points out that, for the analysis of market demand, it is equally desirable to consider the prices at which a given supply can be sold. Thus, he develops the marginal valuation theory to parallel the usual approach. This is used mainly in his treatment of consumers' surplus, in which he distinguishes between various measures of this value.

Important theorems are developed in regard to substitute commodities. The *first substitution theorem* states that the total substitution effect of any price change, however complex, must always be positive (or zero). The *reciprocity theorem* deals with the reciprocal nature of substitute goods—if A is a substitute for B, B is a substitute for A. For the cross-effects to be of equal magnitude, more restrictive conditions are given. The *second substitution theorem* sets a limit on the size of the cross-effect which is consistent with a given direct effect. Further, attention is directed to the influence of income effects for certain types of

commodities, which complicate the statements that can be made about the relationships among commodities. This is aggravated further when dealing with commodity aggregates.

Hicks does not deal with welfare aspects here; he plans to devote a later book to these. Also he confines his analysis to relationships between current prices and commodities purchased, and does not deal with explanations in terms of deferred or lagged effects of price changes, although he admits the importance of this area of analysis.

To those who find certain mathematical formulations of demand theory difficult to comprehend, the present volume will be useful, though this does not mean that it is easy to read. But the effort involved in reading it will be well repaid.

Gordon King

The Meaning and Validity of Economic Theory: A Historical Approach. By Leo Rogin. Harper & Bros., New York. 684 pages. 1956. $6.50

LEO ROGIN was professor of economics at the University of California until his untimely death 10 years ago. He started as an agricultural economist, but became interested in economic theory and devoted most of his life to that subject. The book under review is a critical history of economic thought in the last 200 years. Unfinished at the author's death, it was prepared for publication by his widow with the assistance of some colleagues and former students.

Rogin's main thesis is that the "objective" meaning of economic theory can be recognized only in connection with the formulation of economic policy. Its corollary is that economic theory is validated only in its practical application. Rogin believed that a historian of economic doctrine must check an economic theory for its truth just as a natural scientist does. But in economics, "where reference is not to a constant external nature but to the ever-changing historical configuration of human affairs, theory that does not orient itself to the requirements of contemporary practice feeds on the bare bones of bygone practical issues and is destined to be both socially reactionary and scientifically sterile."

This hypothesis does not emphasize the theorist himself and his individual background, but rather the institutional and political environment of the time, which provides the "central public issue" to which the new theory is addressed. As the meaning of a new theoretical system first emerges in the "concealed or unconcealed guise of arguments in the realm of social reform," it follows that the evaluation of its validity "involves judgments as to the adequacy of the theoretical articulation in the light of its present aim, and judgments as to the possibility of the aim being realized in given historical circumstances. There can be no question of a uniquely correct theory. Different practical and normative perspectives call for different selection and organization of facts."

This is strong, heady stuff. Whether or not the reader finds it palatable will probably depend upon whether or not he agrees with Rogin's philosophy of economics. The latter is best revealed by another quotation, not from the book this time, but from an earlier article criticizing the life and work of Werner Sombart (who supported National Socialism in his later years):

"There is an element of truth in the aphorism, 'there is no disputing tastes.' Nevertheless, a naturalistic, common-sense view of normative judgments, particularly ethical judgments, will recognize that they are not beyond exploration and criticism. Such a view will reckon with their origins, their acceptance and diffusion and, above all, their implications in the context of human experience. These all imply an appeal to facts, and the latter, particularly, implies criticism in terms of our practical social interests. Such criticism is arrested at the source if we conceive normative judgments to be the offspring of an immaculate conception hatched in a Platonic heaven."[1]

This is no narrow view of the scope of economics. Rogin does not hesitate to criticize the normative judgments of previous thinkers, and his own become evident in the process. This reviewer was a graduate student in Rogin's semi-

[1] "Werner Sombart and the Uses of Transcendentalism." Amer. Econ. Rev., XXXI, 493–511 (Sept. 1941). The quotation is from p. 501.

nars some 20 years ago, and he has considerable sympathy for Rogin's viewpoint and conclusions. Even those readers who disagree are likely to find his arguments a powerful stimulus to their own thinking.

It would be a mistake for this or any other reviewer to try to decide whether Rogin has proved his hypothesis in any absolute sense. He himself would probably not have made any such claim. In the book, he says only that he is exploring a hypothesis or illustrating what he hopes is a fruitful method of approach. Later on, he states that his primary aim is not to provide definitive judgments on past theories, "but rather to suggest criteria for the choice and elaboration of general frames of reference—principles of economics—at the present time."

In other words, if Rogin were alive, his position probably would be that this is the way in which many significant schools of economic theory got their start, that some economic theories have not been particularly significant because they did *not* conform to his hypothesis, and in any case, that this is the way economic theory *should* be developed if it is to make sense in its contemporary historical setting.

Whether or not one accepts Rogin's thesis, it certainly provided Rogin with a useful springboard for criticism. The result is a refreshing contrast to the factual and dry-as-dust histories of economic doctrine. Rogin's work cannot replace these histories because it is too selective in its coverage, but it provides a welcome addition to them, at least on the graduate level.

The book is not without its faults. Rogin's writing style is rather heavyhanded. But the impact of his ideas is usually such as to overcome this handicap, with the result that reading him is often difficult and fascinating at one and the same time.

A second fault, perhaps stemming from the first, is occasional lack of clarity in expression. This arises partly from the fact that Rogin was doing his best to elucidate the obscurities of earlier writers. Partly, however, it is just Rogin. He sometimes failed to make himself clear in seminar. Challenged by his students, as he always was, he could make himself clear, but usually it required some effort, and occasionally he would postpone further explanation until the next session. The results were always worthwhile. It is unfortunate that Rogin did not live to put the book together himself. If he had, the challenge of reviewers in draft form would certainly have stimulated him to the extra effort he needed for lucid expression.

Despite its faults, the book well serves its main purpose—to memorialize the name of a great teacher. This must be an appreciation of a life as well as a review of a book. Intellectual power and intellectual arrogance often go together. Not so with Rogin. He was genuinely interested in the welfare of his students. Had he been less so, this book might have appeared in his lifetime.

Ernest W. Grove

Experimental Designs. Second Edition. By William G. Cochran and Gertrude M. Cox. John Wiley & Sons, Inc., New York. 611 pages. 1957. $10.25

ENLARGEMENT of the older work, rather than its revision, is the apparent purpose of this publication, as most of the material in the first edition is retained. The first edition has been brought up to date, and enlarged, by including designs developed during recent years.

The book has two new chapters that deal with factorial experiments, besides a half-dozen new sections. One of the new chapters is concerned with fractional replications, the other with methods for approximating the response surface for continuously variable factors and for determining optimum combinations of factor levels. New sections added to previous chapters cover incomplete block designs (balanced and partially balanced), chain-block designs, and designs for isolating residual effects of former experiments. Added also are tables of F and t distributions.

The authors' approach is again nonmathematical. To provide a kit of designs for ready reference rather than to develop facility in planning and analyzing experiments by applications of basic principles is their apparent purpose. As in the earlier edition, the first three chapters of the revised work provide a foundation of theory, which is extended in the later chapters to more

complex designs. Statistical inference, hypothesis testing, and estimation are discussed with respect to design and analysis, as are least squares and analysis of variance and covariance.

The mathematical model of randomized blocks is outlined and the basic assumptions are clearly stated. Methods are given for subdividing the sums of squares for treatments and error and for the computation of standard error of comparisons among treatments, and these methods are conveniently reduced to rules.

Although attention is given to the effects of error in the underlying assumptions, a comprehensive discussion of analysis of variance and its use in estimating variance components are lacking. This omission, however, is consistent with the approach taken by the authors.

Based on the theory established in the first three chapters are a dozen more which deal with these topics: Completely randomized blocks and Latin square designs, factorial experiments, confounding, factorial experiments in fractional replication, split-plot designs, factorial experiments confounded in quasi-Latin squares, response surfaces, balanced and partially balanced incomplete block designs, lattice squares, incomplete Latin squares, and the analysis of the results of a series of experiments. For each of the major designs, a numerical example is completely worked out, and a series of accompanying plans is given, together with a bibliography listing sources of mathematical derivations and research reports of experiments that use the design.

The place of this work in statistical literature was firmly established by the first edition. Its value as a reference for experimenters and as a textbook in applied statistics is widely known. It provides an accessible source of suitable designs for nonspecialists in statistics when the services of a statistician are not available—this has been its main contribution.

This modernized edition should prove even more valuable than its predecessor, and should serve to extend the use of sound statistics in experimentations.

Bruce W. Kelly

Science and Economic Development: New Patterns of Living. By Richard L. Meier. Technology Press of Massachusetts Institute of Technology and John Wiley & Sons, Inc., New York. 266 pages. 1956. $6

IN RECENT YEARS the reading public has been told many times about the world's rapidly growing population, its shrinking resources base, and the inevitability of crisis. Moreover, the rapid gains in the conquest of disease and the control of mortality were shown as adding to the problem, for in major areas of the world they were not being accompanied by reductions in birth rates. Hence disparities resulting from rapid growth were increasing. It has been argued frequently that efforts at economic development in many areas face an impossible task, for any amelioration of the present plight could not be sufficient to offset the demands of a rapidly growing population.

Meier accepts as basic to his investigation that world population will grow to 3–3¾ billions by the year 2000 and will probably continue to increase to something like 5 billion persons. With needs added up on one side of the ledger and the capacity to supply these needs on the other, he attempts to find critical points in the future when specific needs will begin to exceed potential supply. Under present patterns of production and consumption, this date is given at about 1960 for protein foods and some time after 2000 for carbohydrate foods. Supplies of fiber and paper are assumed to be adequate. Outside North America the use of fossil fuel would begin to decline about 2050, long before the anticipated energy needs of the growing population have been met. Energy supplies in North America, however, may last for several centuries. The availability of some common metals will be primarily a function of the availability of energy. For the future, energy-conserving innovations will become more needed than energy-using developments.

Given the necessary development of technics of needed changes in tastes and standards and of social organization, it is held that the earth can probably provide comfort and convenience for upward of 50 billion people. This is not considered a desirable prospect and the means of providing for human welfare under these conditions are far from clear. Particularly difficult is the problem

of getting started on a system of production that can develop the momentum needed to make for improvement of human welfare in the face of initial high rates in the growth of population.

These conclusions are based on an examination of present technology and the possibility of developing new foods and new fuels, with more attention to solar energy than to atomic energy and emphasis on the prospects of reducing the needs for energy without reducing comfort and convenience. There is considerable attention to the new economic and social patterns that would have to be developed, recognizing that the patterns developed in the United States, with its extravagent use of most resources, are not suited to most other parts of the world. The structure of new urban complexes with a high degree of self-sufficiency in food production, and the industrial pattern that might be adapted to such a world are outlined in some detail.

The purpose of such a book is to provide an imaginative outline of a possible course for economic development. In meeting this task, the author has set aside such problems as the specific methods by which the desirable goals might be achieved, and the present imbalance in the world's distribution of people, rates of growth and resources. The world is treated as a whole, and though it is recognized that the standards and patterns of the highly industrialized areas cannot be taken over directly to many parts of the world, present differences in levels and rates of development and in rates of capital growth are not considered. The book necessarily leaves more questions unanswered than it attempts to answer. But the approach is grounded in a hard look at the present situation worldwide, and the assumptions concerning technological development are based on what is already known and developed, at least experimentally. The publishers refer to it as a provocative appraisal—and it is that.

The function of such a book should be to get people to take a hard look at some of the assumptions that regularly come into discussions of these problems. This in itself is a worthwhile accomplishment.

Conrad Taeuber

Motivation Research in Advertising and Marketing. By George Horsley Smith. McGraw-Hill Book Co., Inc., New York. 242 pages. $5

BECAUSE IT IS REMARKABLE for its organization and nontechnical presentation of complex psychological research methods which are of growing significance to agricultural economists, attention of readers of this journal is directed to the book—even 3 years after its publication. This reviewer understands that Smith's volume is now considered by many specialists to be *the* authoritative guide to these methods. It is sponsored by the Advertising Research Foundation.

Certainly, the book is not likely to be surpassed for some years as a handbook on "why" research for agricultural economists interested in marketing research. I doubt if another handbook on research methods in *any* area contains so much useful material in so few pages, or is so ably written. The double contribution of excellent descriptions and illustrations plus extensive references to more technical works qualifies this book as required reading in any course in social science research methods.

In terms that we who have had no more than a single course in psychology can understand, the author introduces each topic by reference to the clinical and experimental literature, and then develops the implications for advertising, marketing, and communications. Both his emphasis on continuity with other social sciences and his conclusion that motivation research ". . . is *not* a substitute for regular marketing research, for business judgment, nor for creative inspiration" will strike responsive chords in our fraternity.

Motivation research is person centered, not directly market oriented. Smith prefers the name "why" research because it focuses attention on ". . . the whole battery of inner conditions that play a dynamic part in a person's buying or not buying. . . ." These variables include assumptions; attitudes; sensations, feelings, and images; motives, identification, and empathy; rational and critical processes; habits and conditioned reactions. Knowledge of these help market researchers to increase their capacity to predict actual behavior in a concrete situation.

The author points out that older methods of market research are primarily applicable to ascertaining material that people can discuss more or less freely, and occasionally to material that is rarely discussed (because of deep personal involvement). Then he considers inner conditions or variables of which a person is not aware and cannot discuss, and which are not reached by conventional market research. To delve into these areas, special research tools have been developed by psychologists during the last 50 years. Smith's description of these tools and their adaptations to modern market research is so beautifully done that the reader's learning process is positively painless.

Beginning with principles and procedures of single-person and group interviewing, he leads into the so-called projective techniques used to bypass the personal defenses and to uncover subtler relationships. He pauses now and then to warn his readers of the limitations of these techniques. Here on page 77, to cite one such case, he tells us, "Indirect methods are apt to be most useful when used as part of a survey." And again, two pages over, we are told that, ". . . In short, projective and other disguised tests have a place in psychological marketing research, but they are not the whole show and cannot as a rule carry the entire burden of fact gathering."

Part IV contains the major development of the theme that runs throughout—that motivation research is concerned with specific problems, and that it draws on many sources for solutions to these problems. One chapter tells how other research techniques (psychological ones) fit into the picture, and another deals with interrelations with other methods. The latter stresses the role of motivation research in developing hypotheses, and the need for more familiar survey methods to test them and to interrelate the variables.

The last part of the book, "Getting the Job Done," covers the when, who, and how of motivation research. On the subject of "when," the author writes, ". . . When the quantitative or 'nose-counting' approach is not a sufficiently clear-cut guide for action, then something is needed—something that gets into a new dimension of the problem." Perhaps agricultural economists should read this part first because it points out both (1) our place on the team quarterbacked by a social psychologist, and (2) what kind of a score we can expect from these new methods.

Smith believes that motivation research will pay its way when it provides new leads, clarifies or systematizes knowledge, confirms hunches, gives the "why" behind what is already known, and serves as a negative (or dampening) influence, by detecting weaknesses in proposals which lack adequate psychological insight.

Now, a criticism from a sidewalk superintendent. Smith apparently misuses the term "depth interviewing" to describe what other psychologists call "intensive interviewing." At the 1957 meeting of the American Farm Economics Association, F. A. Kilpatrick described "depth interviewing" as a "psychoanalytic term which refers to an interview conducted for 1 or 2 hours a week over a period of from 2 to 5 years."

Finally, a question: Where and how did George Horsley Smith learn to write so skillfully?

Marguerite C. Burk

Year Book of Labour Statistics 1955. International Labor Office, Geneva. 1955. 455 pages. $5

This is the 15th issue of the Year Book, which the preface indicates, "presents a summary of the principal statistics relating to labor in all parts of the world." Tables and text are in English, French, and Spanish. The 41 tables cover total and economically active population, employment, unemployment, hours of work, wages and labor income, consumer prices, family living, social security, industrial injuries, industrial disputes, and migration. Appendix tables give indexes of industrial production, wholesale prices, and exchange rates. Statistical series are shown annually for the pre-World War II years of 1937–39, and pick up again with annual data from 1948 on. Monthly or quarterly data are given when available for the most recent years and are shown up to June 1955.

The Combined Food Board: A Study in Wartime International Planning. By Eric Roll. Stanford University, Food Research Institute. xiii, 385 pages. 1956. $7.50

ERIC ROLL is well known to American economists as the author of the excellent *History of Economic Thought*, first published in 1938, when he was professor of economics and commerce at the University College of Hull. He is better known to United States food and agriculture officials in World War II as a member of the British Food Mission in Washington, and as Executive Officer and Deputy Member for the United Kingdom side of the Combined Food Board. On the basis of this experience and his distinction as an economist, Roll is a logical selection to write this history of the Board, which is published as the 11th volume in the Food Research Institute Series—"Food, Agriculture, and World War II." Although at present Roll is an Under Secretary in the Ministry of Agriculture, Fisheries, and Food, this study is offered, not as an official account, but as the contribution of an individual scholar.

As he states in his introduction the 11 chapters of the book fall into three parts. The first three are concerned with the origins and establishment of the Combined Food Board. Topics covered include problems of food procurement by the United Kingdom in the United States; the establishment of the British Food Mission in the spring of 1941; informal arrangements for joint action; and finally, the formation of the Combined Food Board in June 1942. These are illuminating chapters, with the narrative moving along nicely.

The next four chapters cover the activities of the Board from about the middle of 1942 to the end of 1944. The first of this group deals with such matters as the staffing of the Board, development of procedures, and the setting up of the committees, particularly the commodity committees, which provided the principal basis for the ultimate recommendations of the Board to the member governments. Changes in organization and personnel that occurred throughout the period are outlined. The most important of these was the addition of Canada in October 1943. Stress is laid on the continued concern of the British with the effectiveness of the United States food organization and the level of representation on the United States side.

Next come chapters on "Allocation in Theory" and "Allocation in Practice." Roll's position is that it was not feasible to establish any very useful set of general principles for allocating supplies. It was necessary to rely on extended discussion, including cross-examination by claimants for the different countries, out of which emerged methods of allocation applicable to the particular case under consideration. Considerable space is given to the study known as the "Consumption Levels Inquiry," which compared the 1943 levels of food consumption in the United States, Canada, and the United Kingdom. He stresses the importance of these agreed-upon basic data as providing a firm underpinning for the discussion of allocations.

The Board's recommendations for international commodity allocations formed the core of its activities. "Allocation in Practice" is devoted to a summary of the work of four of the more important commodity committees; namely, sugar, meat, fats and oils, and cereals. The description of the work of these committees indicates the far-reaching nature of the problems that commanded the attention of the Board. The final chapter in this second group, "External Relations," covers various activities of the Board which cannot be classified as allocation, such as relations with other combined bodies and UNRRA.

The last three chapters in the foregoing group contain much strictly factual material describing actions and procedures. Underlying controversies and the role of individuals recede into the background. All in all, the resultant 175 or so pages make rather slow reading.

The tempo quickens in the five final chapters, which cover the last 18 months of the Board's existence, when emphasis shifted from war needs as such to problems created by allied plans for liberation and to the postwar organization of food and agriculture. Chapter 8, which I regard as the best in the book, covers the food crisis of 1945, the inability of the Combined Food Board to cope with it, and the resultant Tripartite Food Conference (April 1945) which at least served to keep the machinery for international food allocation in operation for the more critical commodities. Fol-

lowing is a chapter on organizational problems that arose as the end of the war came into sight. These involved not only the Combined Food Board but the other Combined Boards as well.

Next comes an account of the Board's allocation activities during the final 12 months of its existence. Special attention is given to cereals, which was becoming the most critical area of food management; inability to cope with it contributed materially to the breakdown of the Combined Food Board. Chapter 11 is largely focused on events in the early part of 1946 which led to the end of the Board and the setting up of the International Emergency Food Council in July of that year.

The last chapter "contains a broad appreciation of the accomplishments of the Board together with an indication of some of the lessons that may be learnt from its history." Roll rates the accomplishments of the Board rather higher than do some other students of food and agriculture in World War II, and lays special stress on the contribution which the experience gathered in the Combined Boards has made to effective intergovernmental organizations in the postwar period.

An appendix contains several items of special interest to students of food and agriculture during World War II. These include a chronology of important events relating to the Board, a roster of top personnel at several stages of the Board's life, a complete list of CBF recommendations, and a number of selected documents. The book is enlivened by three photographs of the Board at various stages of its existence. Incidentally, the individual at the extreme right of the first photograph is *not* Carl Hamilton, as indicated, but Dr. H. B. Boyd.

What can be said about the book as a whole? It is evident that Roll has painstakingly unraveled the tangled skein of the Combined Food Board's activities and skillfully rewoven the main strands into a meaningful pattern. In so doing, he has produced what appears likely to be the standard reference on the Combined Food Board for some time to come. This does not mean that he has resolved all questions concerning the operations and accomplishments of the Board as a wartime agency. This could hardly be expected. The precise accomplishments of most of the war agencies in the United States are still matters of controversy. Persons intimately concerned with the activities of such agencies as the War Production Board, the Board of Economic Warfare, the War Food Administration, and the Office of Price Administration still hold divergent views as to the effectiveness of various programs, the contribution of these programs to the war effort as a whole, and the reasons why some efforts fell short of their mark.

To take just one example, Roll appears to make the effectiveness of the Board largely a function of the organizational ups and downs of the United States food agencies. This, of course, is an important part of the story, but by no means all. The dominant position of the United States as a food supplier contrasted with the relatively small quantitative claims of the British against American supplies certainly helped to create an inherent difference of viewpoint within the Board.

Personally, I am inclined to attribute some of the difficulties to a more fundamental situation, namely, the totally dissimilar position of the United States and the United Kingdom with respect to civilian requirements and supplies. For many civilian goods, United States wartime supplies exceeded prewar levels; hence civilian supplies frequently appeared as large residual items that could be further reduced if military needs demanded. Only a relatively few items became so short that they had to be tightly controlled and allocated with the same severity as munitions. In Britain the reverse was true. An extensive array of civilian goods had to be rationed below prewar levels. Given the shipping situation, the problem of civilian supplies became of the greatest concern, and the connection between civilian supplies and the British war effort was abundantly clear.

To be more specific, a 2- or 3-percent change in food supplies per person in the two countries had a totally different significance in each, so far as the conduct of the war was concerned. This fundamental difference could hardly fail to have unfortunate effects on the joint food-planning effort.

James P. Cavin

The Marketing of Livestock and Meat. By Stewart H. Fowler. The Interstate Printers & Publishers, Inc., Danville, Illinois. 1957. 622 pages

AS THIS BOOK WAS WRITTEN by an animal husbandryman who has had considerable experience in marketing, it is apparently intended primarily for producers, livestock extension specialists, and undergraduates majoring in animal husbandry. Nevertheless, as the first new or revised book on livestock and meat marketing to come forth in 16 years, it will be examined with interest by many livestock and meat-marketing economists. A thorough and up-to-date text in the livestock and meat field has been a pressing need for some time.

Organization of the book, including chapter headings and subheadings, closely parallels the last text by Dowell and Bjorka. But the description of handling methods, operating procedures, and physical facilities for most of the marketing institutions is considerably more detailed. This new book is also more readable and is replete with photographs and advice to the producer. It is more concerned with "how to do" as well as "what is done." But it contains less historical discussion of the economic development of marketing institutions and is considerably less analytical than the older book.

Chapters on the meatpacking industry, market agencies, shrinkage and feeding of livestock, and livestock losses appear to be particularly well done. Three chapters on topics not treated in earlier books in the field are included. One is concerned with preparation of livestock for shipment; another deals with byproducts of the meatpacking industry; and the selling of purebred livestock is discussed in the third.

Documentation follows the style of texts in the basic sciences. In discussing the controversial subject of direct marketing and selling by carcass weight and grade, the author skillfully used the technique of liberal citations. The student is taken on a somewhat nondirective course through the controversies, a course that nevertheless leads toward rather sensible thinking.

This technique becomes more labored in a chapter on seasonality of marketing and prices, where 18 separate references are cited to the point that livestock marketings tend to be concentrated in the fall. Most economists would have been content to go to statistics of the Department of Agriculture on this point, or perhaps to a single publication that would provide the best source for illustrative charts.

In other parts of the book, the author might have been more liberal with both quotation marks and citations. Some researchers may feel a certain strange familiarity with particular passages for which no citations appear.

It seems unfortunate to this reviewer that the author did not seek out an agricultural economist to coauthor his book. Apparently he realized his limitations with respect to demand and consumption economics and price analysis. Sections and chapters of the book dealing with these topics are scanty in coverage and elementary in nature. At some points, economic terms are used improperly. The section in chapter II that deals with the factors affecting demand and the chapter on livestock prices, particularly, are inadequate for a general text on livestock and meat marketing. The chapter entitled, "Determining the Value of Livestock and Meat," actually deals only with some of the factors, mainly grades, yields, and classes of livestock and meat, that affect prices received by producers.

Dynamics of marketing is not adequately appreciated. For if there is one central fact in livestock marketing, it is that marketing institutions, marketing patterns, and marketing practices are constantly changing. The author tends to arrive at generalized conclusions from temporally and spatially heterogenous bits and pieces of evidence without due regard to growth and change in the marketing system.

Some of the most recent and important developments that affect all segments of the livestock and meat industry have taken place at the wholesale and retail levels. Many of these are barely touched upon in the book. The author disposes briefly of wholesale and retail meat distribution in one catchall chapter that contains five additional major subdivisions.

At least three other texts in this field are known to be in preparation. (Several other starts have been abandoned. This is not said to discourage any other budding textbook writers.) No doubt,

this book will perform a useful service and provide a valuable text at academic institutions where livestock marketing is taught in animal husbandry departments. Most teachers who are trained in the discipline of agricultural economics, however, will probably agree that there is room for another text.

Willard F. Williams

The New Revolution in the Cotton Economy. By James H. Street. University of North Carolina Press, Chapel Hill, N. C. 251 pages. 1957. $5

COTTON PRODUCTION is a farm industry that has been late in mechanizing. As Street points out, mechanization of cotton production actually started with the invention of the cotton gin late in the 19th century, but after this invention there was little progress toward the ultimate goal until after World War II. Street analyzes the causes of the lag in mechanization and its social implications from the time of the invention of the cotton gin until the early fifties. His analysis has many social as well as economic implications.

Street begins his analysis by tracing the influence of the cotton gin on the expansion of cotton production through the use of slave labor. He then describes the institutions that developed after the War Between the States to provide for hand labor after the slaves were freed, and shows how these institutions tended to keep cotton production on a hand-labor basis. These included, among others, sharecroppers, credit arrangements, and size of farms. During the depression of the 1930's, Government programs tended to preserve the use of hand labor in production of cotton.

Next, Street traces the development of equipment needed to mechanize cotton production. He points out that, aside from the tractor, mechanized equipment used to produce other crops has not been adequate for cotton production. He traces the rather long history of the attempts to develop mechanical cottonpickers. He then points out that the successful development of the mechanical picker came at a time when new methods of cultivation, such as check rows, were applied to cotton production. Also, new methods of weed control were being developed.

Street then indicates the effect of World War II on the cotton industry and points out the "pull" influences associated with the postwar boom on the movement of farm population away from cotton farms, indicating the stimulus provided for the adoption of mechanized cotton production. At the end of the book he looks into the future, indicating that once mechanization has been adopted, it is difficult to return to the old system of hand labor. Developments in mechanized equipment and techniques are now on the threshold, and he believes that a continuation of the pull factors on farm population will probably cause further mechanization of cotton production.

The book skillfully relates the institutional factors that have affected the development of mechanized cotton production with the technological difficulties of developing adequate equipment and techniques. Students of the cotton industry will find the book interesting and refreshing in its approach. Economists will find it an excellent case study of the development of more efficient production in a specific agricultural industry.

Frank Lowenstein

The World Fertilizer Economy. By Mirko Lamer. Stanford University Press. Stanford, California. 715 pages. 1957. $12.50

PROFESSIONAL WORKERS and general readers concerned with questions of fertilizer technology, production, consumption and trade, will find *The World Fertilizer Economy* a useful reference tool. Much emphasis is placed on these problems as influenced by World War II.

In examining the contents of the different chapters, one is impressed by the large amount of information covering the many aspects of the subject. The book is perhaps better reviewed under several broad topics rather than in chapter order. These topics, with relevant chapter numbers, are

as follows: 1. Basic Information on Fertilizer Production and Use (chapters 1 to 5, 9, and 21); 2. Consumption in Various Countries (chapters 6, 22 to 28); 3. Wartime Problems as Influenced by Organization of the Industry, Trade Practices, Prices, and Changes in Supply and Demand during the War Period (chapters 8, 10 to 20, 29, 30, and 31); 4. Production Potential and Outlook for Consumption (chapters 7 and 32).

The value of the book as a reference and for general reading purposes would have been enhanced had the different chapters been grouped along these lines.

Basic information on fertilizer production and use.—Some basic information is summarized regarding the nature of fertilizers as plant growth stimulants, fertilizer production processes, the influence of environmental factors on response to fertilizer, and the nature of the response function. The chapter on origin and classification of fertilizers outlines the historical development of fertilizer and is based largely on the works of De Suassure, Boussingault, von Liebig, Lawes and Gilbert, and others. This chapter outlines the processes used in the manufacture of different fertilizer materials. Technicians may find a few minor errors in the description of some of the manufacturing processes.

The presentation of the basic considerations concerning yield response to fertilizer represents a valuable addition to the subject, particularly for readers whose experience has not brought them in touch with this aspect of fertilizer economics. An interesting note introduced is the clash of the principle of diminishing marginal productivity with the official Communist line, as reflected in Soviet policy. The author points out, however, that Russian scientists recognize operation of the principle. Lamer also discusses the diminishing returns principle in both "point in time" and longer time terms, including in the latter, consideration of the effect of general improvement in agricultural methods on the whole position of a productivity function.

The chapter on competition among fertilizers is a mixture, which includes the question of economic substitution of nutrients in crop production and the competitive aspects of the industry with respect to production of the different principal plant nutrients. The first of the problems might well have been included in the discussions of yield responses; the second would have been better in a separate chapter that could have followed the chapter in which production processes are discussed.

The comparison of inorganic fertilizers with manures as suppliers of plant nutrients (chapter 21) appears to belong early in the book, where the relative availability of nutrients in fertilizers and manures is discussed.

Consumption of fertilizer in various countries is introduced in chapter 6. Here the subject is discussed in relation to the development of agriculture, population, and other factors. The later chapters that deal with this subject present data on the extent and intensity of use, togther with some discussion of factors that influence use in the different countries. Information on application of fertilizer to different crops is included. Discussion of fertilizer use in the Soviet Union is of particular interest because of the author's familiarity with that country, and the dearth of information regarding the Russian economy. Other countries included in the discussion of fertilizer use are the United States, the British Commonwealth, Germany, Japan, Egypt, and Switzerland.

Wartime problems.—The main purpose of a series of some 20 volumes, of which this book is one, as stated in the preface, is "to illuminate the complex aspects of food and agriculture, and World War II. Wartime problems in use of fertilizer are exhaustively treated. International trade in fertilizers is traced through four periods, (1) before World War I, which is characterized as a period of natural monopolies during which natural deposits comprise most of the important sources of inorganic fertilizers; (2) the interwar period, when, after rapid development of new chemical processes, and pressure of fertilizer supplies, world production and trade became united under collective agreements; (3) the World War II period, which was characterized by dissolution of international cartels and individual government controls; and (4) the postwar period, during which a seller's market largely prevailed, at least up to the time the book went to press.

Wartime fertilizer prices are discussed, along with changes in supply and demand during and following World War II, and dissolution of Ger-

man and Japanese national monopolies and international cartels after the war.

The wartime fertilizer pattern, with phosphate supplies mainly in the hands of the Allies, European potash supplies chiefly in the Axis orbit, and the activities of the Combined Food Board in fertilizer allocations, is discussed in detail. About 40 pages are devoted to fertilizer resources in the Soviet Union. Understandably, there is less discussion of wartime management of the fertilizer problem there than in most of the other important countries involved in the war.

Production potential and outlook for consumption.—Chapter 7 treats briefly the potential fertilizer production, based on reserves of phosphate and potash mineral deposits and on industrial capacity for synthetic nitrogen. Chapter 32, Fertilizers in the Future, consists of only about two pages. These two chapters might well have been brought into sequence and expanded, particularly the latter, in order to present a more thorough picture of the probable role of fertilizers in the future.

In résumé, the book is to be commended for the wealth of material it contains, but its organization could have been made more effective. Each chapter is followed by an exhaustive reference list. Many additional details are included in appendix tables.

D. B. Ibach

A World Geography of Forest Resources. Edited for the American Geographical Society by Stephen Haden-Guest, John K. Wright, and Eileen M. Teclaff. Thirty-five contributors. The Ronald Press Co., New York. 1956. 736 pages, illus. $12.50

ANY COLLABORATIVE EFFORT that seeks to treat comprehensively a subject as broad and complex as world forest resources within the confines of a single cover is likely to have shortcomings, and this work is no exception. Yet, despite its deficiencies, the book constitutes a most welcome and valuable addition to forestry literature. It helps to fulfill the need for an up-to-date appraisal of the world's forest resources at a time when the demands for forest goods and services are rapidly expanding, and when political, economic, and technological changes are markedly altering the world pattern of forest development and use.

The approach employed in this study of forest geography is essentially regional. Twenty-five of its 31 chapters, accounting for upward of 500 pages of the text, are devoted to a review of the forest situation in individual regions and countries. Primarily descriptive rather than analytical, they deal with such subjects as forest areas and types, commercial timber species, exports and imports, timber volumes and growth, forest policies and programs, and forest industries. Preceding this regional section are five general chapters that serve as an introduction. They cover, respectively, the importance of forests to man, the forests of the past and present, forest influences, principles and practices of forestry, and the forest-products industries of the world. A concluding chapter summarizes the work, emphasizing primarily the outlook for the world's forests and their chief products.

Taken as a whole, it is the regional section that is the least satisfactory. Prepared by 29 contributors of varying experience and competence, and in the apparent absence of a uniform outline, it suffers from faulty organization and imbalance in subject-matter coverage. The reader finds it difficult, and often impossible, to make comparisons between regions or countries in terms of specific elements of their respective forestry situations.

Although more complete planning in advance relating to the type of material to be included and its order of presentation would have served to improve these chapters substantially, not a small part of their imbalance in coverage is obviously the result of the wide degree of variation that exists among countries in the status of forestry development. This is evidenced by the appraisals presented for the advanced forestry nations of Europe and North America, for instance, which in general are considerably more comprehensive than those offered for most of the industrially underdeveloped areas.

The principal value of this book will perhaps stem from the fact that it brings together a wealth of the most recent data and information available on the world's forest resources and their use. A large part of the statistical and descriptive ma-

terial given in the regional section has previously appeared in printed form, but in such a widespread array of specialized reports, books, bulletins, and the like that it could be accumulated only at the expenditure of much time and effort. The value of the book as a general source is further enhanced by bibliographic references at the end of each chapter and a bibliographical note and botanical index in the appendix.

Educators, research workers, and public officials who require ready access to basic world forestry statistics and information are thus likely to find the book most useful. However, its introductory and concluding chapters should prove of interest to everyone, professional or layman. Prepared by men especially well qualified for the task, they are clearly written and provide a refreshing insight into what forest resources are, how they contribute to the support of man and his activities, and how they have fared under his stewardship.

Charles C. Larson

Selected Recent Research Publications in Agricultural Economics Issued by the United States Department of Agriculture and Cooperatively by the State Colleges[1]

ALLEGRI, T. H., AND HERRICK, J. F., JR. MATERIALS HANDLING IN PUBLIC REFRIGERATED WAREHOUSES. U. S. Dept. Agr. Mktg. Res. Rept. 145, 119 pp., illus.

Report describes food handling in warehouses. It points out how costs of handling foods in many public refrigerated warehouses can be reduced substantially by changing to carefully planned methods and equipment.

BALL, A. G., HEADY, E. O., AND BAUMANN, R. V. ECONOMIC EVALUATION OF USE OF SOIL CONSERVATION AND IMPROVEMENT PRACTICES IN WESTERN IOWA. U. S. Dept. Agr. Tech. Bul. 1162, 91 pp., illus. June 1957. (Iowa Agr. Expt. Sta. cooperating.)

Using three case farms in western Iowa, the writers worked out a crop program and eight livestock programs for each farm for 1952 to 1957, inclusive. It was assumed that prices would remain steady at the 1952 level, that they would decline from the 1952 level to a level of 225 percent of 1910–14 prices by 1958, but would remain steady thereafter. With steady prices, it would take a minimum of 4 years for a soil conservation plan to provide a higher annual net farm income than extension of the present plan. At 1952 prices, it would take a minimum of 7 years for accumulated net farm income under a conservation plan to exceed accumulated net farm income under the present plan.

BECKLER, R. I. A SUMMARY OF SELECTED RECENT STUDIES ON BROILER FINANCING AND CONTRACTING. U. S. Dept. Agr. AMS–183, 16 pp. June 1957.

Many studies of broiler financing and production contracts have been made in parts of the United States in recent years. These studies have been published individually by many research agencies. This report brings them together in summary form. It is limited to a review of selected publications released since 1951.

BREWSTER, J. M., AND CLARK, S. P. CONVERSION OF SMALL HYDRAULIC COTTONSEED OIL MILLS INTO HIGHER OIL-YIELDING MILLS. U. S. Dept. Agr. Mktg. Res. Rept. 187, 73 pp., illus. July 1957.

Report gives findings in detail of the costs and operations of five oil mills of differing sizes. It compares the relative advantages and disadvantages of converting small hydraulic cottonseed oil mills into screw-press or prepress-solvent mills. Changes in equipment and methods required by conversion are described.

BURCH, T. A., AND BUTLER, C. P. ECONOMIC ANALYSIS OF ANNUAL ADJUSTMENTS IN DEVELOPING A GRADE A DAIRY IN THE PIEDMONT AREA OF SOUTH CAROLINA. S. C. Agr. Expt. Sta. Bul. 442, 57 pp., illus. March 1957. (In cooperation with Production Economics Research Branch.)

Dairying appears to be a profitable alternative for some of the low-income cotton farms in the Piedmont area. It would take about 7 years, with about the same level of living as in 1954, to liquidate the debts for the additional investment needed. But capital can be accumulated fairly rapidly, and after the 7 years of adjustment, net cash receipts would be about $8,900. Net returns to the operator for his labor and management would be around $7,000 at prices slightly lower than in 1954. Results are based on reorganization of the farming system and on changes in production practices to permit higher yields and more efficient production.

CORTY, F. L. IN COLLABORATION WITH MEMBERS OF THE SOUTHERN REGIONAL DAIRY MARKETING COMMITTEE. THE POSITION OF DAIRYING IN THE SOUTH. A Southern Regional Dairy Marketing Project Report. Southern Coop. Series Bul. 46, 46 pp., illus. September 1956.

Report answers such questions as, "What proportion of all farms (in nine-State area) keep milk cows? How many of these are dairy farms? Is the South now a milk surplus or deficit area?" An analysis of these and other questions sheds light on the position of dairying in the South.

[1] Processed reports are indicated as such. All others are printed. State publications may be obtained from the issuing agencies of the respective States.

CROWE, G. B., AND CARNS, H. R. THE ECONOMICS OF COTTON DEFOLIATION. Miss. Agr. Expt. Sta. Bul. 552, 26 pp., illus. June 1957. (In cooperation with the Farm Economics Research Division, ARS.)

Results of a study conducted in 1953–55 in 8 locations in the Yazoo-Mississippi Delta showed that about 3 million acres are treated for this purpose. Net returns to defoliation ranged from a profit of $3.21 per acre to a loss of $23 per acre; 5 of the 7 locations showed a loss. Largest contributing factor to the losses was reduction in yield, which amounted to as much as $20 per acre.

DWOSKIN, PHILIP, AND JACOBS, MILTON. POTATO FLAKES—A NEW FORM OF DEHYDRATED MASHED POTATOES: MARKET POSITION AND CONSUMER ACCEPTANCE IN BINGHAMTON, ENDICOTT, AND JOHNSON CITY, NEW YORK. U. S. Dept. Agr. Mktg. Res. Rept. 186, 43 pp., illus.

Results of a market test for potato flakes are here analyzed. It studies consumer response and acceptance during the test period, and assesses the product potential and the future possibilities for a market for potato flakes.

EDGAR, A. D., CLAYCOMB, R. S., AND HANSEN, J. C. FLUME SYSTEMS FOR HANDLING BULK-STORED POTATOES. U. S. Dept. Agr. Mktg. Res. Rept. 177, 16 pp., illus. June 1957.

Based on research at the Red River Valley Potato Research Center, in Minnesota, this report is part of a project to develop more efficient work methods for off-farm handling of late-crop potatoes. The flume system, and how it affects labor savings, is explained.

FREY, J. C., GERTEL, KARL, AND JEFFREY, A. D. AN ECONOMIC APPRAISAL OF IDLE LAND IN POTTER COUNTY, NORTH CENTRAL PENNSYLVANIA. Pa. Agr. Expt. Sta. Bul. 621, 30 pp., illus. May 1957. (Farm Economics Research Division, ARS cooperating.)

In 1953, idle land in the county exceeded 40,000 acres, an equivalent of 69 percent of the county's cropland. Idle land was most common on properties occupied by part-time and nonfarm families, but was found on all kinds of farms. Average incomes of rural families in 1954 ranged from $600 for elderly and retired families to $3,600 for off-farm workers. Too small averages appeared to account for low income on many commercial farms. On nonfarm properties, it was not poor quality of land that caused it to be idle but preoccupation with nonfarm work. About half of the idle land in the county was suited to crop production.

GREENMAN, J. R., AND ENGLISH, J. J. THE LAWS OF FARM TENANCY AND SHARECROPPING IN FLORIDA. Fla. Agr. Expt. Sta. Bul. 586, 48 pp. June 1957. (Pub. 26 Southeast Regional Land Tenure Com.) (In cooperation with Production Economics Research Branch. ARS.)

The chief rights and obligations of landlords, tenants, employers, and sharecroppers are set forth in this bulletin. Many of them are defined in Florida statutes and in decisions of the Florida Supreme Court, but some have not been so defined.

GUILFOY, R. F., JR. A CURTAIN TO HELP MAINTAIN TEMPERATURES IN LOCAL REFRIGERATED DELIVERY TRUCKS. U. S. Dept. Agr. Mktg. Res. Rept. 176, 21 pp., illus. May 1957.

Reports on using a polyester plastic curtain in frozen-food trucks to prevent heating. Curtain was tested under actual operating conditions, and temperature evaluation tests were conducted. It appears to be a practical means of maintaining cold temperatures inside refrigerated delivery trucks during hot weather.

HAREN, C. C. LAND RESOURCES OF FLUVANNA COUNTY, VIRGINIA. U. S. Agr. Res. Serv. ARS 43–31, 98 pp., illus. July 1957.

Settlement began in Fluvanna County more than two centuries ago, but three-fourths of the land is still in forest and brush. Only about half of its ownership units, many of which are on soils suited mainly to forest, are occupied, and few families obtain their entire livelihood from farming. Less than 60 percent of its two potentially most important agricultural soils have ever been in cultivation. Because of many inquiries as to opportunities to establish farms here, this study was made to learn whether people should be encouraged to do so. The problems and costs involved in locating and establishing farms of various kinds are set forth.

HENDERSON, P. L. MEASUREMENT OF THE RATE OF MOVEMENT OF APPLES INTO CONSUMPTION AND FACTORS ASSOCIATED WITH THE MOVEMENT OF APPLES IN RETAIL FOOD STORES. Va. Agr. Expt. Sta. Tech. Bul. 129, 74 pp., illus. January 1957.

Information was assembled to help apple producers and marketing agencies in adjusting the movement of apples over the normal marketing season and to aid in supplying consumers' wishes, and for services connected with merchandising apples. Investigates alternative techniques of reporting the movement of apples into consumption.

HINDS, R. H., JR., JOHNSON, H. D., AND HALDEMAN, R. C. A PERFORMANCE TEST OF REFRIGERATED RAIL CARS TRANSPORTING FROZEN FOODS. U. S. Dept. Agr. Mktg. Res. Rept. 182, 26 pp., illus.

Reports performances of two types of mechanically refrigerated rail cars and a standard water-ice and salt-refrigerated car hauling packaged frozen corn from Waseca, Minn., to Jersey City, N. J. Shows how differences in refrigerating capacities of mechanically refrigerated cars cause wide variations in the time needed to precool the cars before shipping frozen foods in them.

HUELSKAMP, H. J. EVALUATION OF RETAIL MERCHANDISING PRACTICES FOR PEARS, PEANUT BUTTER, AND CREAMERY BUTTER. U. S. Dept. Agr. Mktg. Res. Rept. 180, 16 pp., illus. June 1957.

Controlled retail store experiments were carried out to measure the effect of specific practices on the sales of pears, creamery butter, and peanut butter, for 8 weeks. Includes study of display techniques, amount of spoilage, effects of advertising.

HUGHES, W. F., AND MAGEE, A. C. WATER AND ASSOCIATED COSTS IN THE PRODUCTION OF COTTON AND GRAIN SORGHUM, TEXAS HIGH PLAINS, 1955. Tex. Agr. Expt. Sta. Bul. 851, 15 pp., illus. March 1957. (In cooperation with the U. S. Dept. of Agriculture.)

Rising costs of water and machinery, along with higher rates of power, labor, and water use, during the last 6 years have increased the cost of producing irrigated cotton and grain sorghum on the Texas High Plains. Cost of producing cotton on dry land is $10.38 per acre; grain sorghum, $5.11. Irrigated cotton with high-cost water, 39 acres per well, costs of $65 per acre; grain sorghum, $41. With medium-cost water, the costs drop to $54 and $29, respectively; and with low-cost water to $48 and $24. On heavy land, costs for cotton are slightly less and for grain sorghum slightly more.

HUNTER, J. S. PURCHASER'S OPINIONS OF FROZEN CRANBERRIES IN MINNEAPOLIS-ST. PAUL. U. S. Dept. Agr. Mktg. Res. Rept. 183, 27 pp.

Reactions to frozen berries of homemakers who took part in a study about the berries are reported. It is intended to provide the industry with data on consumer acceptance of frozen cranberries.

KAHLE, H. S. PROCESSING POULTRY BYPRODUCTS IN POULTRY SLAUGHTERING PLANTS. U. S. Dept. Agr. Mktg. Res. Rept. 181, 77 pp., illus.

Poultry slaughter plants handling large volumes of birds can profit by adding a plant for processing byproducts and wastes. Situations in which byproduct processing is profitable and in which it is unprofitable are described and discussed.

LEWIS, W. E. MAINTAINING PRODUCE QUALITY IN RETAIL STORES. U. S. Dept. Agr. Agr. Handb. 117, 30 pp., illus.

Handbook provides information regarding desirable temperature and moisture conditions for daytime display, overnight holding, and storage of reserve supplies for short periods.

MERCHANT, C. H. LIVESTOCK DEALERS' OPERATIONS IN NORTHEASTERN UNITED STATES. Maine Agr. Expt. Sta., Maine Bul. 555, 43 pp., illus. May 1957.

Summary of the operations of livestock dealers in 11 Northeastern States. Information is included on dealers' businesses, handling of replacement animals, sources of purchases, and sales outlets for all livestock and business practices of dealers.

MOORE, E. J. WHOLESALING FLORAL COMMODITIES IN THE CHICAGO AND NEW YORK CITY MARKETS. U. S. Dept. Agr. Mktg. Res. Rept. 175, 32 pp., illus.

Local wholesale growers provided about three-fourths of the total volume of Chicago and New York floral supplies in 1955. Information is here given on the wholesale market location, sources of supply, types of suppliers, procurement methods and practices, modes of transportation, marketing channels, and marketing costs.

MAGEE, A. C., AND ROGERS, R. H. FINANCING A BEEF CATTLE ENTERPRISE ON BLACKLAND FARMS. Tex. Agr. Expt. Sta. Bul. 862, 11 pp., illus. May 1957. (In cooperation with U. S. Dept. Agr.)

Results of the study on 23 farms in Bell and McLennan Counties during 1952–54 indicated that at 1956 costs and market prices, a well-managed beef herd would probably be a good investment on Blackland farms. At 1956 prices, 12 beef cows would pay for themselves in 4 to 9 years, depending on the method of feeding calves.

MANCHESTER, A. C. ORANGE TREE TO BREAKFAST TABLE. U. S. Dept. Agr. Mktg. Res. Rept. 164, 12 pp., illus. June 1957.

Less than a fourth of the retail price of a box of Florida oranges went to the grower in 1955–56, according to this report. One of a series of marketing and costs studies, it compares Florida oranges sold in Chicago with those sold in New York, difference in prices, who gets what part of the retail price, and reason for price differences.

MYERS, K. H. AN ECONOMIC APPRAISAL OF GREEN CHOP FEEDING. Pa. Agr. Expt. Sta. Prog. Rept. 170, 8 pp., illus. April 1957. (In cooperation with the Farm Economics Research Division, ARS.)

Computations made in this study indicate that green chopping on a typical Pennsylvania farm would permit addition of three cows to the herd. The operator's labor income would be increased by about $600, if he already owned a field forage harvester. If he had to buy one, he would increase his labor income by about $400.

POATS, F. J. MARKETING MOLASSES IN THE FEED-MIXING INDUSTRY. U. S. Dept. Agr. Mktg. Res. Rept. 174, 20 pp., illus. May 1957.

Livestock feed has replaced fermentation alcohol as the primary market outlet for molasses since World War II. Study surveys 227 firms on the use of molasses for feed mixing, the differences in rates of use, price relationships, and other factors involved in the molasses-feed-mixing industry.

POWELL, J. V. COSTS OF PACKING COLORADO PEACHES IN 1956. U. S. Dept. Agr. Mktg. Res. Rept. 179, 34 pp., illus. July 1957.

Average annual costs of packing Colorado peaches in 1956 are reported in detail. Costs include labor, overhead, and materials. Some suggestions are given on how to reduce these costs.

PRITCHARD, N. T., AND HESTER, O. C. PRICING EGGS AT WHOLESALE IN CHICAGO AND ST. LOUIS. U. S. Dept. Agr. Mktg. Res. Rept. 173, 26 pp., illus. May 1957.

Growth of direct purchasing of cartoned eggs by large retailers in Chicago from country shippers has sharply reduced wholesale trading in eggs in that market. Price quotations in Chicago therefore might better be based on prices paid by retailers than on wholesale selling prices as at present. Reports on conditions of egg trade in Chicago and St. Louis.

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REUSS, L. A., ROBERTS, N. K., AND GREENE, R. E. L. PANGOLAGRASS PASTURES FOR BEEF PRODUCTION IN CENTRAL FLORIDA—A METHOD OF DETERMINING THE ECONOMICS OF ESTABLISHING AND FERTILIZING THEM. Fla. Agr. Expt. Sta. Bul. 585, 36 pp., illus., May 1957. (In cooperation with Farm Economics Research Division, ARS.)

Production of beef on most Florida ranches can probably be increased in the future. This study was intended to illustrate by use of ranch budgets the types of information and analyses that will help ranchers decide whether it would be more profitable to use available capital to apply more fertilizer on their existing improved pastures, to develop additional acres of improved pastures, buy better quality livestock, or make other improvements.

SAINSBURY, G. E. STORAGE AND COOLING CAPACITY IN APPLE STORAGES IN THE WENATCHEE-OKANOGAN, WASHINGTON, DISTRICT. U. S. Dept. Agr. AMS–196, 6 pp.

Study brings up to date a 1941 survey of cold storages in the apple-producing districts of northcentral Washington.

SMITH, W. L., JR., AND OTHERS. PEACH HYDROCOOLING, SHIPPING, AND FUNGICIDAL TESTS. U. S. Dept. Agr. AMS–199, 20 pp., illus.

Describes tests used to measure the effect of temperature on ripening and bruising of peaches shipped at different maturities and reduction of decay by using fungicides in the hydrocooling water. Information is included on the results of hydrocooling tests.

SPERLING, CELIA. THE AGRICULTURAL EXEMPTION IN INTERSTATE TRUCKING—A LEGISLATIVE AND JUDICIAL HISTORY. U. S. Dept. Agr. Mktg. Res. Rept. 188, 71 pp.

The words and the deeds of Congress with reference to the agricultural exemption clauses in interstate trucking are included in this report.

STOKES, D. R., AND BARRY, GOODLOE. DEVELOPMENT OF CARROT PREPACKAGING. U. S. Dept. Agr. Mktg. Res. Rept. 185, 36 pp., illus.

Only 1 percent of the fresh carrots marketed were sold in prepackaged form as recently as 1951. By 1956, about 84 percent were prepackaged. This report tells of this shift and describes problems encountered in marketing carrots in prepackaged form. After studying 5 plants in California, Arizona, and New Mexico, it was shown that packinghouse labor requirements could be reduced as much as 37 percent.

STOUT, R. G. MARKETING CATTLE AND CALVES THROUGH SOUTHERN AUCTIONS. (Agr. Expt. Stas. of Alabama, Arkansas, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Virginia, West Virginia, in cooperation with U. S. Dept. Agr.) Southern Cooperative Series Bul. 48, 40 pp., illus. February 1957.

Reports on research started in 1953 to learn the kind and quality of slaughter cattle and calves sold at southern auction markets and to study the relationship of several factors to the prices paid for these animals.

STRICKLER, P. E., AND MORGAN, J. J. FERTILIZER AND LIME APPLICATION ON FARMS, 1954. U. S. Agr. Res. Ser. ARS 43–49, 16 pp., illus. April 1957.

Information on the methods of applying fertilizer and lime and trends in the use of these materials is given here.

TOWNSHEND-ZELLNER, NORMAN, AND MARTIN, L. C. RAISIN MARKETING, PRELIMINARY ECONOMIC HIGHLIGHTS. U. S. Dept. Agr. AMS–204, 27 pp., illus. August 1957.

In recent years the United States has produced almost 40 of every 100 tons of raisins and currants produced commercially in the world. Report includes information on per capita consumption of raisins, major outlets for United States exports, prices, returns to growers, and production but touches these subjects very briefly.

Statistical Compilations

U. S. AGR. MKTG. SERV. FIELD AND SEED CROPS, BY STATES, 1949–54, FARM DISPOSITION, SEASON AVERAGE PRICE, VALUE OF PRODUCTION, VALUE OF SALES (REVISED ESTIMATES). U. S. Dept. Agr. Statis. Bul. 208, 88 pp. May 1957.

U. S. AGRICULTURAL RESEARCH SERVICE, FARM ECONOMICS RESEARCH AND SOIL AND WATER CONSERVATION RESEARCH DIVISIONS. FERTILIZER USED ON CROPS AND PASTURES IN THE UNITED STATES—1954 ESTIMATES. U. S. Dept. Agr. Statis. Bul. 216. August 1957.

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